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Switchgear Design.

THE importance of switchgear in electricity supply under modern conditions of high pressure and large power needs no emphasis; it is sufficiently demonstrated by the dimensions and cost of the switchgear itself and of the buildings in which it is housed, all of which appear to be altogether out of proportion to the size and cost of the generating and transforming plant which it controls, and even then it cannot be claimed that heavy circuit-breakers can be relied upon to do their duty under all conditions for long periods without incurring heavy costs for maintenance and repair—indeed, it is no rare thing for the breaker itself to "go West" when opening a heavy short circuit. In the early days British engineers were foremost in the development of novel types of switchgear to control the high-pressure a.c. transmission system of which they were the pioneers, and the names of Ferranti and Partridge are for ever honoured in this connection; then for some years American practice went ahead and was adopted in this country, but a radical departure was made when ironclad switchgear was introduced by Reyrolle and Clothier—another British innovation—and forced its way to the front by sheer merit, even in the United States.

But we are far from approaching finality. As long ago as 1926 the Electrical Research Association reported that discoveries had been made which indicated the possibility of increasing the rupturing capacity of circuit breakers by hundreds per cent., and later reports have corroborated that assurance, though with the too-limited financial resources of the Association it has not been possible as yet to put the new ideas into practice;

we hope that good progress is being made towards that end. More recently Mr. G. E. Whitehead has introduced a simplified design (see Elec. Rev., June 15th, 1928, p. 1044), which appears to offers material advantages; and in the *Electrical World* of July 28th an account is given of a new method of enclosing bus-bars, circuit breakers, &c., in sheet-metal casing, without the use of concrete, which has been adopted for a 33-kV outdoor switching station in Illinois.

It is evident, therefore, that close attention is being given to this subject, which is admittedly of the first importance to the industry. Not only is progress being made in the evolution of switchgear of known types—necessarily tending towards simplification and lessened cost—but also new methods of interrupting power circuits are being studied, and we may yet see, as in the case of steam power plant, revolutionary changes in the design of switchgear.

Electric Power in Industry.

During the progress of the Electricity (Supply) Bill in 1926 we pointed out that no great benefit to our manufacturing industries was likely to accrue from the operation of the national scheme, which was directed solely to the reduction of generating costs; for the cost of power represented only a trifling percentage of the selling price of the products. Some statistics recently published by the *Electrical World* amply bear out this view, showing that, with the exception of industries depending wholly on electrical processes, such as ore reduction and electrochemical work, none of the industries that were examined reported a higher proportion of power cost than 4 per cent., and in most cases the proportion was less than 2 per cent. Even steel works and rolling mills were in the latter category.

Whilst it is not the cost of electrical energy—already very cheap in our industrial areas—that handicaps our industries, there is another aspect of the question which receives too little attention: the fact is that many manufacturers do not yet realise the advantages of electric power in their factories. There is no doubt that manual labour is far more costly than mechanical labour, and wherever human agency can be replaced by machinery, economy will result. Economy of labour means cheaper production and increased employment. To the superficial observer this statement may appear paradoxical, but its truth has been abundantly demonstrated in the history of industry. It is by the increased use of electric power that our industries will benefit, and not by the insignificant reduction in the cost of electricity which is all that even the Central Electricity Board hopes to effect in that direction. Here, again, arises the question of distribution, on which the Act unfortunately has no bearing: it is, as the Board's representatives have explicitly stated, a matter for the authorised distributors—it is their function to develop the supply of electricity by persuading every potential consumer to adopt electricity for all purposes.

Received with Thanks.

A loyal and highly responsible servant of an engineering company was commended by a director of that company, but another director at once said: "You don't want to tell *him* that." The official's semi-jocular reply was pointed and pregnant. Said he, "I'm told soon enough when it's the other way about!"

The fear that even well-merited approval, if expressed in words, will only tend to inflate a man's opinion of himself, and make him offensively officious and annoyingly importunate for monetary reward, generally underlies the disinclination felt in many quarters to give praise where praise is due. This feeling may be natural enough, and in certain instances justifiable enough. In most cases, however, the fear is quite unfounded; and indeed the frigid and unrelieved silence may turn out to be poor policy. Many men are so constituted that sober and responsible recognition of good work done encourages them to even worthier effort. "Yes, Doane, that just suits this case; I'm pleased you have got the right hang of the thing" means much to Doane. Doane then surprises his employers only less than he does Doane. For Doane looks at his job with keener eyes, makes wiser suggestions, and works with mind alert as well as hands active and facile.

Recognition of services rendered is in keeping with the new and better spirit which is permeating industry. The Locarno spirit in works and offices, as well as between nations and sections within a nation, is a splendid and an intensely practical and constructive factor. It makes for peace, for consolidation, and for that prosperity which deserves the success it achieves. This temper is neither the need nor the prerogative of any one person or party. It should characterise each and all. It is not merely for Lord Melchett to make the friendly gesture and hold out the friendly hand; Tom Workman, too, needs to make the friendly gesture, hold out the friendly hand.

Frank and judicious acknowledgment of useful services rendered is at once fair-play and essentially good and sane dealing. But do the employés realise that it may on occasion be up to them also to acknowledge benefits received at the hands of their employers? The "Thank you for what you have done" may call for a reciprocal "Thank you for what you have given." They work best who work with enthusiasm and interest. When there is, moreover, welcome exhibition of company loyalty, there is an impalpable *extra* which is of incalculable value, making a tremendous difference to the quality of the service as well as the extent of the turnover. Worker and company benefit alike.

Electricity from Sewage.

One of the valuable qualities of electricity is its adaptability to the utilisation of energy from sources of the most varied descriptions, which would otherwise be wholly wasted. An interesting example of this facility is afforded by the sludge gas power plant of the Birmingham Tame and Rea Drainage Board, which in 1926 adopted a scheme for utilising the methane gas evolved from the sludge-digestion tanks at its Saltley sewage works; the plant has been in operation since last September, and the results are in accordance with the forecast that it would be capable of producing 500,000 kWh per annum. According to *The Times Trade and Engineering Supplement*, the Board contemplates the extension of the gas-engine plant to enable the output to be increased to 1,500,000 kWh per annum, at a cost of £18,000, effecting a net saving of £2,500 a year.

Thus the operations of the microscopic bacteria which convert the sewage into sludge, water, and gas are being turned to good account in another direction, providing even more power than the Board at present requires.

High-frequency Currents.

The article which commences on the following page—specially contributed at our request—gives a brief but exceedingly interesting account of the remarkable phenomena associated with oscillating currents at very high frequencies. In some respects these are similar to the effects demonstrated 37 years ago by Count Nikola Tesla, which attracted world-wide attention, but they are much more varied and energetic, owing to the higher frequencies and greater power at command—another outcome from the development of the thermionic valve, which has already been so fruitful in electrical progress and is destined to play a part of constantly growing importance in electrotechnology. As we advance further into the unexplored region of wavelengths between the shortest used in radio-communication and the longest in the infra-red, new phenomena are discovered which certainly are surprising and may be accompanied by danger to the experimenter, as in the case of the X-rays—which, however, are at a relatively enormous distance down the scale.

High-Frequency A.C. Generation.

This informative article, specially contributed from the Research Laboratory of the American General Electric Co., describes some experiments with a high-power generator of alternating current at extremely high frequencies and some of the resulting effects, which disclosed remarkable facts.

By E. D. McARTHUR.

ENGINEERS working on the production of high-frequency power have for some time been trying to realise, in practice, a generator capable of delivering an amount of power measurable in kilowatts at as high a frequency as possible. In order to obtain the desired amount of power, regardless of frequency, water-cooled thermionic valves must be used, although they are at the same time the limiting factor, because their physical dimensions and large inter-electrode capacities prevent the construction of an oscillating circuit suitable for operation at the extremely high frequencies desired; in many cases the inductance of the leads and the inter-electrode capacities form a closed circuit whose natural frequency is

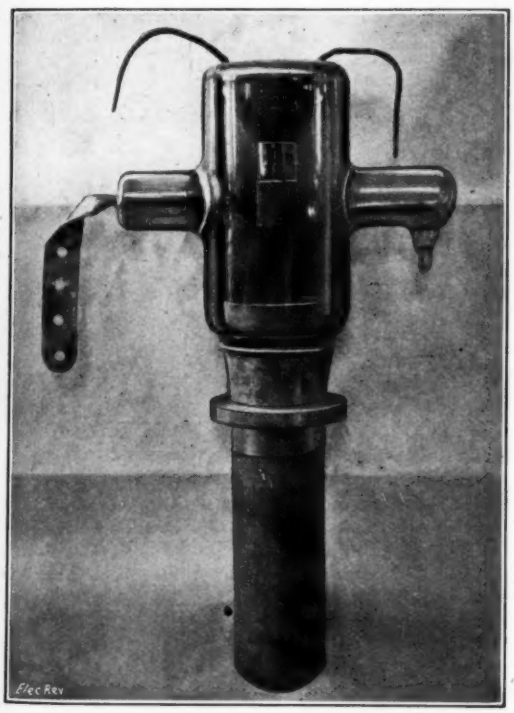


Fig. 1.—Type ZT-6 Water-cooled Valve.

3×10^7 cycles, or lower, even with the shortest possible circuit.

Recently, however, a valve has been built which, although it is yet in the experimental stage, promises to reduce the wave-length boundaries down to an extent not hitherto reached. It is this valve (fig. 1) and its operation with which this article is concerned, and it is to be understood that the above statements only apply to the high-power, high-voltage, class of water-cooled valves. Of conventional design so far as the grid and filament are concerned, it has an anode whose diameter is about three times that of the usual design (being 9 in. long and $3\frac{1}{8}$ in. in diameter) furnishing a surface area capable of dissipating 20 kW of power when cooled with water flowing at the rate of 3 gallons per minute. This is one of the facts which make possible the operation about to be described, because high-frequency oscillators are usually low-efficiency devices. Another, and perhaps more important, fact is that increasing the plate diameter to such an extent lowers the inter-electrode capacity and makes operations at short wave-lengths possible. The filament is rated at 52 amperes at 22 volts, and is capable of about 10 amperes emission; the amplification constant is about 45, the normal operating plate potential being 15,000 volts.

The experiments were performed with a self-excited oscillator (figs. 2 and 3), with feed-back effected by capacity coupling in the valve. The plate and grid coils each consisted of a single turn of heavy copper tubing, separated electrically by a high-voltage condenser. The direct-current connections were made as usual through choke coils.

Ordinarily, oscillators operating above 15 metres may be loaded for test purposes by coupling a symmetrical arrangement of 250-watt lamps to the output circuit. When the experimental oscillator was built, a similar load was incorporated, but it was found that the circuit was too large to load correctly; some of the lamps would be overloaded while others were barely red, which effect was due to "standing" waves in the circuit. The only successful load was found to be a half-wave antenna, which, while entirely satisfactory electrically, radiated all of the energy and caused a great deal of disturbance to near-by equipment. After some trouble, the oscillator was made to operate, and it was found that the wave-length was 5.6 metres, corresponding to a frequency of 53.6×10^6 cycles; accordingly, an antenna was used which was just short of 2.8 metres long. An attempt was made to measure the current at the current loop, but the results were so inaccurate that they were useless. All other data on output power were obtained by measuring the anode dissipation and subtracting that from the input.

Thermo-couple meters of all kinds within 200 ft. of the antenna would either indicate or burn out. In one case a thermo-ammeter that normally reads 50 amperes full scale was found to be reading 15 amperes, although there were no connections to the instrument. This condition caused very great inconvenience, because work in other parts of the laboratory had to be suspended while the experiments were being carried on in a large room whose walls were made of metal screening. The latter was supposed to be at ground potential, but, if a small lamp bulb were brought in contact with one of the vertical members and its position varied, distinct voltage and current nodes and loops could be found; it was possible to find points where the lamp would light to full brilliancy, while perhaps only a foot or two away there would be no indication of potential. In one side of the cage was a metal door running on metal rails: if it were opened or closed while the oscillator was in operation, the track would emit a shower of sparks due to the potential difference between the door and the cage proper.

During operation, it was found impossible to ground the set at any point. The usual practice with a circuit of this kind is to ground the filament connection of the valve, but, since the shortest possible ground lead was more than one wave-length long, it was possible to find current and voltage nodes and loops at various points on the supposedly earthed conductors, which caused considerable trouble due to the large currents flowing in the filament-heating transformer and the rheostat;

several transformers and rheostats were destroyed thereby. Condensers are entirely useless for protection, for they will not by-pass enough current to afford any measure of relief. It is unwise also to provide too many possible closed circuits near the oscillator, because each circuit which is in resonance will draw a large amount of energy from the oscillator and occasionally stop the oscillation; this trouble was encountered several times and was extremely difficult to locate.

As a result, the reference point for the various voltages in the oscillating circuit could hardly be expected to be at zero, or ground, potential. Two conditions are possible: first, that the zero-voltage point is located somewhere between the potential of the grid and that of the filament. In other words, we may consider the valve to be excited by swinging the filament potential to some definite instantaneous value below the imaginary zero, while at the same instant the grid has assumed a definite potential of opposite polarity to that of the filament. Under these conditions, a definite potential difference will be established between the grid and filament in the correct phase and the circuit will oscillate. The other condition, and the more probable one, is that the reference point of voltages is at the filament, but that the potential of the entire structure, taken as a unit, is varied at a radio-frequency rate due to the voltage drop in the ground lead. Neither of these assumptions affects the operation of the oscillator, but they do explain the fact that a large current can be drawn from almost any point in the circuit to ground without hindering the operation of the oscillator.

Figs. 2 and 3.—Self-excited 6-metre Oscillator, Front and Side Views.

The experiments were continued to determine what the highest possible operating frequency was and to discover the maximum power output of the circuit at various frequencies. The following table gives the results of this work:—

Anode Potential.	Anode Current.	Power Output.	Frequency.
12,000 volts	1.9 amperes	15.0 kW	49.2×10^6 cycles.
10,000 volts	1.4 amperes	5.0 kW	60×10^6 cycles.
8,000 volts	.7 amperes	0.8 kW	69.8×10^6 cycles.

During the course of these experiments some very interesting phenomena occurred, and the experiments began to take the form of spectacular displays. For instance, when a glass tube about 4 ft. long and 0.75 in. in diameter, having a metal electrode in each end and filled with pure neon gas, was brought into the field, ionisation of the neon could be started by touching one of the electrodes to the cage, or a long piece of wire. Within a distance of 20 ft. of the antenna sufficient potential existed between the ends of the tube to maintain ionisation. The glow, however, instead of being as usual continuous, consisted of what appeared to be egg-shaped lumps of ionised gas, perhaps 1 in. long and slightly smaller than the glass tube in diameter. The current density seems to be very small, because a very intense magnetic field has no effect at all on the size or motion of the "eggs." Nothing seems to effect this discharge except proximity to a body of different potential, or its position in space. The "eggs" are regions of very intense ionisation and consequently brilliant light: by holding the tube in one hand and placing the other at various places on the tube, different effects could be produced; the "eggs" would seem to travel from one end to the other, or perhaps oscillate at a low-frequency rate about a fixed point. It was observed that the glow was most intense when the tube was held in a horizontal position and that it would not remain alight if held vertical. This indicated that points in the horizontal plane were at widely different potential differences, while points in the vertical plane were not, which effect might have been due to polarisation of the field about the oscillator. This glow resembles the ordinary striated discharge, but cannot be classed as the same effect.

The potential at the end of the antenna was so high that an arc started by touching the antenna with a long insulating rod equipped with a metal tip would follow the metal as it was removed and maintain itself in air. Several materials were placed at the end of the antenna to form electrodes; for example, an arc was started from a single carbon electrode at the end of the antenna (fig. 4), which gave a streamer-like discharge about 18 in. long and a very intense white light, the tip of the carbon being maintained at white heat and remaining conical. It was found also that a piece of poor glass would do the same thing as soon as it became hot enough to be conductive. A piece of copper wire under the same conditions became molten almost at once, and drops of liquid copper would fall to the floor.

If an ordinary electric lamp bulb were held in the operator's hand and one of its base terminals made to touch a rod three or four feet long, the bulb would light up to full brilliancy (fig. 5). By this method sufficient potential difference could be maintained to light a 200-watt lamp up to distances of 20 ft., but this does not represent the most that can be done in this direction because, as yet, no attempt has been made to transmit energy over great distances.

Another interesting gas-discharge effect was produced with the so-called "modulometer tube," which is simply a small evacuated chamber having a small metallic electrode in one end and a fine tungsten wire suspended from the other end, the wire extending very nearly to the opposite electrode, but not touching it. After the tube is exhausted it is filled with some such gas as neon or argon, and when it is attached to the circuit by one electrode, a very interesting and beautiful discharge takes place. The tungsten wire becomes very hot and vibrates in circular paths of varying sizes; at the same time ionisation of the gas occurs in highly-localised areas, and there is apparently a flow of gas from hot to cold, or rather high- to low-pressure, areas of the tube, the motion being made visible by the ionisation of the gas. The effect varies continually with the potential applied, and produces a continual change of pattern.

A very striking demonstration of the voltage distribution on the half-wave antenna was obtained by drawing sparks from various points on the antenna. This experiment shows tremendous arcs at the ends of the antenna and other arcs toward the centre, which gradually decrease in size until a point is reached where there seems to be no voltage. The length of the arcs and the position of the points of maxima and minima indicated reflection at the end of the antenna, resulting in a "standing" wave over the metal section. The length of the antenna is adjusted to be slightly less than equal to one-half the operating wave-length.

Fig. 4.—Radio-frequency Arc Drawn from End of Half-wave Transmitting Antenna.

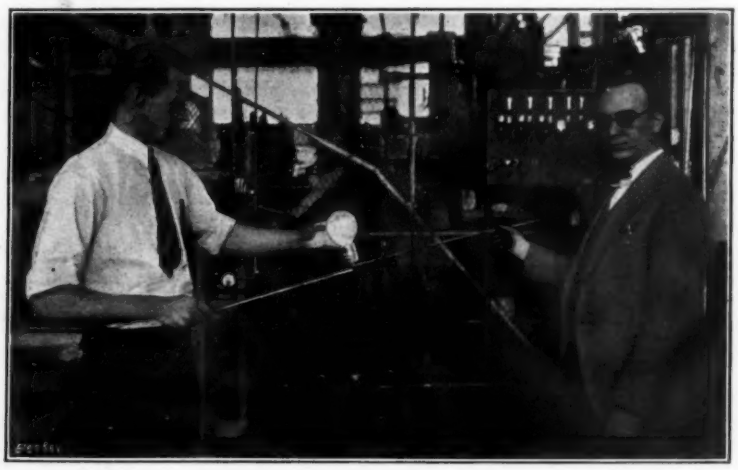


Fig. 5.—A 200-watt Lamp Lighted by "Pick-up" from Oscillator.

An antenna similar to the one connected to the oscillator was set up about 15 ft. from the oscillator and parallel to the transmitting antenna, and some of the previously mentioned experiments were tried with this receiving antenna. At the end of the antenna several 200-watt lamps were lighted to full brilliancy, a total of from 800 to 1,000 watts being obtained in the lamp bank, but, as stated before, this was not the maximum available power. The extreme frequency was again made manifest by the inability to make the lamps light evenly, one lamp out of five or six being invariably near to the burn-out stage. The unevenness of current distribution was such as to discriminate between filament strands in each bulb, due to the proximity of some object at, or near, ground potential. All of the glow-discharge devices operated with great intensity near the receiving antenna, but in other parts of the room the effect was decreased, apparently due to the absorption and field distortion caused by the receiving antenna.

When all of the energy is radiated by the loading antenna, it has been found practically impossible to shield anything from the oscillator. Measurements show the field strength inside of a very well-shielded room to be only a little less than it is out in the open. This effect is largely due to the fact that all of the conduit in which the various power lines are enclosed acts as good transmission lines and exaggerates the field strength at considerable distances from the oscillator.

At this point the experiments digressed somewhat and tended toward heating effects entirely. An effort was made to heat several food articles enough to cook them by placing them in contact with the antenna, so that large radio-frequency current would pass through them. This could be done successfully, but the action was controlled with difficulty because the heating was in general very rapid. Apples were baked by hanging them on the antenna for a few minutes; eggs and sausages were also cooked by putting them in glass tubes and hanging them on the antenna. The same result was obtained in a slightly longer time when using the receiving antenna as a source of energy.

In order to obtain more energy for heating purposes, the oscillator was rebuilt: no antenna was used; the oscillating circuit consisted of two parallel copper ribbons each one about 3 ft. long, connected directly to the grid and anode of the vacuum valve. On the other end of the ribbons an air condenser was connected, consisting of two parallel aluminium plates, one foot square and 15 in. apart. The oscillating circuit then consisted of the inductance furnished by the copper ribbons, principally, and the combined capacity of the valve and the aluminium-plate condenser. No load was placed on the oscillator other than the losses in the oscillating circuit. The oscillating current was very large, but no simple means was at hand to accurately measure the current. With this arrangement as well as the other, the vacuum valve leads are called upon to carry a very large current. The connection to the anode offered no difficulties, since it could be made directly, but the current to the grid must flow through a glass-to-metal seal. In this case the seal assembly is made of 0.35-in. molybdenum rod sealed through the glass wall of the valve. The internal lead to the grid is copper ribbon 0.625 in. wide, and the external lead is 1.5-in. copper ribbon. To give further protection, the filament and grid seals were cooled with an air blast. As yet, no valves have failed due to seal failures.

The heating of various materials could be observed by placing them on a standard between the condenser plates. Heat developed by this means is dependent on the nature of the material under test: in the case of materials of low conductivity, the heating is probably due to dielectric losses and some convection current through the material.

In the case of metals, sufficient potential is built up across the terminal points to force a large current through the body and so produce the observed heating effects. Water in a glass vessel will boil almost instantly under certain conditions. The containing vessel should

be rectangular, preferably with its long dimension placed normal to the surface of the condenser plates, which position permits much larger differences of potential to exist and consequently larger currents to pass through the water. If the vessel is placed parallel to the condenser plates, some heating will occur, but the amount of energy liberated in the water in unit time will be very much less.

This experiment suggests the possibility of drying damp or wet objects: it was found that a mass of wood 4 in. thick and 12 in. square could be dried in a very short time. The wood in this case was soaked in water for some time and then put between the condenser plates; the water began to boil in about thirty seconds, and in less than a minute steam was evolved rapidly; in about two minutes the wood was dry. In one case the wood was left between the condenser plates for a few minutes longer, and later it was found that a large amount of pitch had been boiled out to the surface. In any case, the temperature of the wood is raised sufficiently to make it uncomfortable to handle. The same effect is produced with a mass of wet cloth, and during several of the trials with cloth stray pieces of thread ignited and smouldered. A slower, but safe, drying process can be performed with reduced power.

Again, we return to the electric light for an interesting display: a 200-watt gasfilled lamp was placed between the condenser plates, and its filament became red hot, due to the potential difference at the terminals. If one terminal were touched with a metal-tipped rod, the filament would become much hotter all over and, in addition, would develop one small spot where the temperature was extremely high; almost instantly a ray of yellow light would shoot out from the region about this hot spot and travel to the glass wall, where it would appear to become diffused and lose its definite form. The ray was conical, with the larger part of the cone near the glass, and the cross-sectional area of the base of the cone was about twice that of the apex. The glass immediately over the base of the cone became very hot if the action was continued for more than five or ten seconds. If the rod were removed, an intense blue arc would form between the walls of the glass nearest the condenser plates. The terminals of this arc were bright yellow, and the body of the arc was spotted with very bright points of yellow light, each one of which persisted but a short time. In the meantime the filament would have returned to a dull red glow and the bulb have become cooler. As the bulb cooled, the arc would become less intense and would finally disappear. The whole effect occurred in less than a minute, and was difficult to observe due to the short duration of each phase of the phenomena.

At about this time several men working near the set complained of severe headaches and general physical depression. It was thought that this physiological effect might in some way be connected with the high-power radiation from the transmitter, an idea which found favour, since everyone felt very warm when the oscillator was running, and at times the operator's arms and the lower part of his legs would become too warm for comfort. Some white rats were obtained and put in a cage near the antenna: during the first tests there seemed to be no effect, but later the rats gave evidence of pain, and examination showed their legs to be badly burned. For this experiment full power was used, and the rats were subjected to the field for about 1.5 minutes. The effect was pronounced so long as the power was on, but as soon as the oscillator was stopped the rats showed no further evidence of pain. The heating was most pronounced in the extremities; it was noticed, however, that there was considerable heating just at the base of the tail. The rats remained in a dormant state for a short while, but in a few hours seemed to be entirely normal and none the worse for their experience, excepting one case in which the rat's legs were burned.

On the basis of these experiments further tests were made on some of the men who worked near the set, and the measurements disclosed some remarkable facts. In a period of ten minutes the following effects were produced on the four operators:—

1. The body temperature was raised to fever heat, *i.e.*, 100 to 101 deg. F.

2. The pulse rate was increased as much as 50 per cent. in one case and 30 per cent. in the others.

3. The respiration rate was increased in a slightly less proportion than the pulse.

4. The blood pressure was reduced 10 per cent., average for four people.

These conditions will be recognised as febrile, but they are created artificially and not by the activities of disease. The actions of the human system under these conditions, when continued for long periods of time, are unknown. Some interest has been displayed in the possible use of this device in the medical field.

This has been a very rambling discussion of the subject, but the facts have been given as accurately as possible, especially those dealing with current conduction through various gases. However, the primary object of this work was not to conduct the experiments described, but to construct and put into operation a high-power generator of high-frequency oscillations, which has been done, with the results outlined in an early part of this article.

Research as a Career.

The research worker, whether in commercial industrial employ or engaged upon pure research, is usually the type of man who finds the work itself the greatest incentive. To the man with a comfortable competence the question of monetary return can be, and probably is to a large extent, a secondary consideration.

Needs are so great, however, and the importance of the work is such that the very best brains of the country should be enlisted for this service. The need is at once imperative and national in its scope. Both classes of investigation are urgently required—pure research quite as much as (possibly more than) applied. That the significance of the matter is not realised as it should be does not lessen, but rather intensifies, the appositeness of the appeal.

There is in being, as enlightened engineers and manufacturers know, a system having widespread ramifications, whose object is to further research so that the engineering and other industrial arts may keep well abreast of the forward march of progress. Industry must maintain touch or else industry will be left hopelessly in the lurch. The Department of Scientific and Industrial Research, the various industrial research associations, the National Physical Laboratory, and the university, college, and commercial laboratories throughout the kingdom are dependent—no matter how wise and far-sighted the management, or inspired the programmes of work—for the execution of their researches upon an adequate supply of capable and scientifically-trained investigators.

It ought to be a double call which draws the right type of man to this vitally important vocation. Congenial work, and also remuneration commensurate with the value of the services rendered, should be the bases of the appeal made to the *bona-fide* research worker.

There is not the great inducement that there should be to persuade the requisite number of the highest type of investigators to devote life, talent, and energies to the task. Often the feeling about the whole business, so far as the work of the associations goes, is that it may, after all, only be of a transient nature. The worker would like to feel that he had a reasonable prospect of a life career; and certainly to secure the men who are needed some such assurance of stability of employment should be offered them.

W.R.N.

The Neutralisation of Resistance.

The author outlines a method of neutralising the effect of resistance in a circuit carrying oscillating currents, without distortion or instability.

By W. E. BRUGES, M.Sc.

THE object of this paper is to show how the effect of the inherent resistance of a circuit may be reduced, in cases where it is impracticable to make the resistance as low as is desired. It will be shown that it is quite practicable to neutralise the effect of resistance in a circuit containing capacity or inductance, or both, by the addition of an e.m.f. which

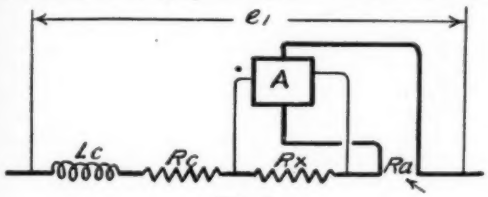


Fig. 1.

is proportional at every instant to the resistance-drop in the circuit: that is, in general, proportional to the current.

The general method to be employed is shown in fig. 1. A valve amplifier is connected up in such a way that the e.m.f. at the terminals of a non-inductive resistance in the circuit is amplified and injected into the circuit.

In fig. 1 R_c is the original resistance of the circuit, R_x the added non-inductive resistance, R_a the resistance of the valve-amplifier, L_c the reactance of the circuit, e_1 the applied varying e.m.f. (instantaneous), and A the valve-amplifier.

Using a thermionic valve, it is possible, by using "capacity" or "magnetic" reaction, to obtain an effect which reduces the apparent resistance of a circuit; however, this type of reaction has many disadvantages. In it two dissimilar e.m.f. waves, which bear no definite relation to one another, are added together. These two waves are generally only slightly dissimilar; the result is that not only can neutralisation not be effected at more than one frequency, but even this neutralisation point cannot be approached without heterodyning when it is desired to receive a signal by wireless.

The advantages to be gained by the type of resistance reaction which has been outlined are great. These will be discussed in detail later; they relate chiefly to tuned

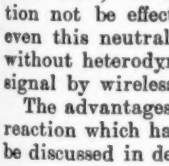


Fig. 2a.

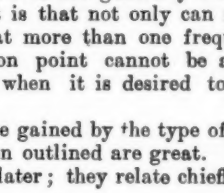


Fig. 2b.

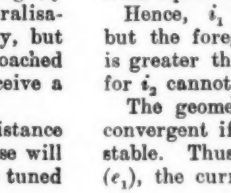


Fig. 2c.

circuits, telephony over long distances, telephony as applied to the exact reproduction of sounds, and to circuits where wave-form is important, or where transient conditions exist. The method is independent of frequency.

Consider first the circuit shown in fig. 2, containing resistance only. In fig. 2a, R_c is the resistance of the circuit, e_1 the instantaneous value of an applied varying e.m.f., and i_1 is the instantaneous value of the current.

Then $e_1 = i_1 R_c$ .....(i)

Suppose, now, that an e.m.f. proportional at every instant to the resistance drop is injected into the circuit in the same sense as the applied e.m.f. (e_1).

Let fig 2b represent the conditions at a particular instant. Let the new current be i_2. After the current has risen to its final value i_2, the injected e.m.f. will be $k\ i_2\ R_c$, where k is some constant. We shall then have— $e_1 + k\ i_2\ R_c = i_2\ R_c$.....(ii)

Going back and considering an instant immediately after the e.m.f. proportional to the resistance-drop is first added, let fig. 2c represent conditions chosen, so that the current at this instant i' is very near the original current i_1. The original injected e.m.f. ($k\ i_1\ R_c$) causes the current to rise to i', and, consequently, the injected e.m.f. automatically becomes ($k\ i'\ R_c$). This increases the current again, and so there is a cumulative effect.

We may imagine that an added e.m.f. $k\ i_1\ R_c$ causes the current to increase to a value $(i_1 + k\ i_1)$. This addition causes the total injected e.m.f. to rise to $(k\ i_1\ R_c + k^2\ i_1\ R_c)$. The current in turn increases to $(i_1 + k\ i_1 + k^2\ i_1)$, and eventually we have:

$$i_2 = i_1\ (1 + k + k^2 + k^3 + \ .\ .)$$
$$= i_1 \times 1/(1-k) \text{ if } k \text{ is not greater than } 1 \text{.....(iii)}$$

The total applied e.m.f. also increases from e_1 to $e_1\ (1 + k + k^2 + k^3\ .\ .)$, that is, to

$e_1 \times 1/(1-k)$, also if k is not greater than 1...(iv).

The circuit is not stable if k is greater than 1.

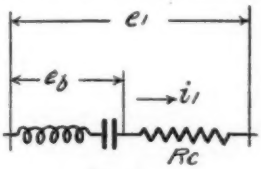


Fig. 3.

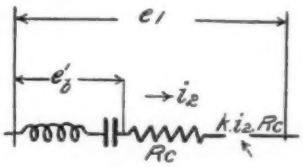


Fig. 4.

Again, from equation (i) we have: $e_1 = i_1\ R_c$, and from equation (ii) $e_1 = i_2 \times R_c\ (1-k)$.

Hence, $i_1\ R_c = i_2\ R_c\ (1-k)$, and $i_2 = i_1 \times 1/(1-k)$; but the foregoing shows that i_2 becomes infinite if k is greater than or equal to unity, and that this value for i_2 cannot be used if k is greater than 1.

The geometrical progression $(1 + k + k^2 + k^3\ .\ .)$ is convergent if k is less than 1, and the conditions are stable. Thus, no matter how small the applied e.m.f. (e_1), the current will tend to become very large as k approaches 1, but will be finite so long as k is less than 1.

Consider now the circuit shown in fig. 3, containing inductance, capacity, and resistance.

In fig. 3, e_1 is the applied e.m.f.; e_b the total reactive back e.m.f.; i_1 the current (instantaneous); and R_c the resistance of the circuit.

We have: $e_1 = e_b + i_1 \times R_c$. Again, injecting an e.m.f., as before, into the circuit (fig. 4), we have: $e_1 + k\ i_2\ R_c = e'_b + i_2\ R_c$, where e'_b = the total reactive back e.m.f. after injecting the e.m.f. proportional to the resistance drop, and i_2 = the final current (instantaneous),

or $e_1 = e'_b + i_2\ R_c\ (1-k)$ .....(v)

Now, the inductance and capacity will provide a back e.m.f., except in the case of the particular frequency for which the circuit is in tune. In the case of a tuned circuit, the resistance only will supply the back e.m.f.

In equation (v) we see that as k approaches 1, e_b approaches e_1. As e_1 increases or decreases, so does e_b. When the circuit is tuned, and $e_b' = 0$, then clearly the circuit will become unstable, oscillating at its natural frequency.

For all other frequencies, e_b exists, and, although we get the same cumulative effect as before, we get stability even when $k=1$. As k approaches 1, e_b and i_2, both (as always) depend on e_1; and we have seen that if $e_b = 0$, the circuit is only just unstable if $k=1$. Also, if $e_b = 0$, the applied e.m.f. rises from e_1 to $e_1\ (1+k+k^2+k^3+k^4+ \ldots)$. When the reactive back e.m.f. e_b exists, the total applied e.m.f. rises in a similar manner, and is not greater than $e_1\ (1+m+m^2+m^3+ \ldots)$, where m is some quantity always less than k; and if $k=1$, m is always less than unity, the series being therefore convergent.

Hence, when $k=1$, the circuit will oscillate at its natural frequency, and at no other frequency; and, further, the oscillation point may be approached without heterodyning an incoming signal.

The quantities used in the above equations are instantaneous values of voltages and currents which are changing at every instant. They are all better visualised as waves.

The effect is demonstrated graphically in fig. 5; in order to do this, it is imagined that a sine wave is applied across an inductance with an iron core (such as a telephone coil) having a resistance R_c.

Diagrammatically, the circuit is as below (fig. 6, a and b), where R_c is the resistance of the circuit, e_1 = the applied e.m.f. (sine wave), e_b = the reactive back e.m.f. (before injection), e_b' = the reactive back e.m.f.

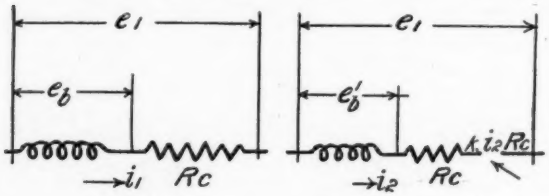


Fig. 6a. Fig. 6b.

(after injection), i_1 = the current (before injection), and i_2 = the current (after injection).

The wave lost owing to resistance-drop is shown, and this when subtracted from the applied e.m.f. gives the wave of e.m.f. which is effective in causing change of flux in our inductance—that is, the wave which is effective in working the telephone; this will be called the effective e.m.f.

Dotted lines are shown to demonstrate the effect of adding an e.m.f. proportional to the resistance-drop. The current and resistance-drop are increased; as k approaches 1, the current is just sufficient to cause the flux in the inductance which is necessary to supply a back-e.m.f. approaching and opposite to the applied e.m.f., the wave of the effective e.m.f. being less and less distorted. All the dotted lines represent what occurs after the e.m.f. proportional to the resistance-drop has been injected.

It should be noted here that if the effect of resistance varies considerably with the frequency, we can still add an e.m.f. proportional to the resistance-drop at every instant, but if the e.m.f. across a portion only of the resistance of the circuit is taken and amplified, this portion of the total resistance must vary effectively as the total (effective) resistance.

Application to a Popular 3-valve Wireless Receiver.

The resistance of the plate circuit of the last valve of a wireless receiving set was "neutralised"; this meant that the effect of the resistance of the valve, iron-cored horn-type loud-speaker, and h.t. batteries, would have to be neutralised.

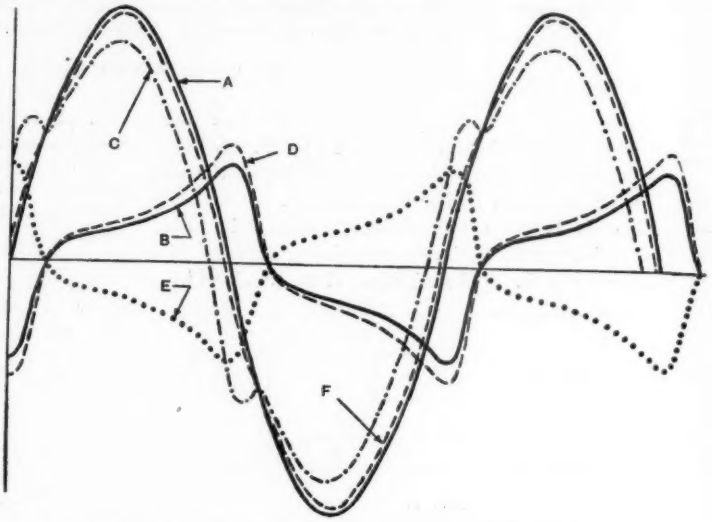


Fig. 5.—The E.m.f.'s in the Circuit shown in Fig. 6.

Curve A represents the applied e.m.f. e_1.

Curve B represents the resistance-drop ($i_1 R_c$).

Curve C represents the effective e.m.f. and is equal to the difference between curves A and B.

Curve D (dotted) represents the new resistance-drop after an e.m.f. proportional to the resistance-drop or current has been added.

Curve E (dotted) represents the injected e.m.f. which is proportional to the resistance-drop ($k\ i_2 R_c$).

Curve F (dotted) represents the new effective e.m.f. after the e.m.f. proportional to the resistance-drop has been injected in the circuit. It is obtained by subtracting the difference between Curves D and E from Curve A.

Note that the effective e.m.f. (Curve F) after the injection of the e.m.f. proportional to the resistance-drop is very much less distorted than the effective e.m.f. before this was done.

The circuit is given below, with details; knowing the ratio of the transformer with which it was decided to feed back (marked T in fig. 7), and assuming that the amplification factor of the last two valves in series would be about 60 over the range of audible frequencies, a rough value for the series resistance (R_x in fig. 7) was calculated, as below; the idea being to obtain the exact value experimentally by using a variable resistance.

Resistance of valve	7,000 ohms.
Resistance of loud-speaker ...	750 ohms.
Resistance of h.t. batteries ...	100 ohms.
Added resistance R_x (unknown) ...	R_x ohms.
Total resistance to be neutralised	$R_x + 7{,}850$ ohms.

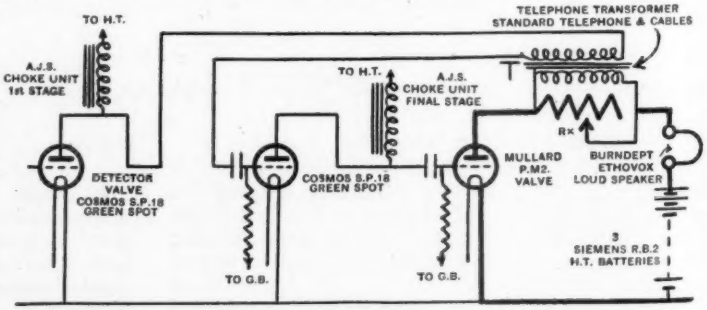


Fig. 7.

Injected voltage = $i R_x$ (ratio of transformer) (amplification factor of last 2 valves).

$= i R_x \times 1.7 \times 60$,

where i is the current flowing in the coils of the loud

speaker; that is, in the plate-circuit of the last valve. For complete neutralisation ($k=1$), this must be equal to $(R_x+7,850)\,i$.

Thus, $(7,850+R_x)=1.7\times 60\ R_x$, and $R_x=78$ ohms.

Two 4-H lead pencils arranged with a slider were used as a non-inductive resistance; the resistance required was actually found to be about 80 ohms in order just to produce low-frequency oscillation, and up to this point the set was quite as stable as usual, and could be left off the oscillation point, when the tone was at its best. The effect was quite independent of the tuning of the set.

The most noticeable fact was the increased volume which was obtained. This was very marked, and was of the order of three times as an estimate. It was the unbiased opinion of various listeners that the tone was improved, the best effect being just before oscillation.

All frequencies will not be amplified to the same extent by most receiving sets. The set used was no exception. Also the transformer (T) used for back-coupling would by its own distortion reduce the advantages of the arrangement. It would naturally be better to couple by making parts of the valve circuits common to one another; but it will be found that this generally involves having separate batteries in the circuits concerned.

Herewith is also reproduced a proof which appeared in the ELECTRICAL REVIEW of February 3rd, 1928, p. 217, showing how the same method may be used to neutralise the distorting effect of the iron in a step-down transformer, no valve or amplifier being required:—

On the transformer shown, fig. 8,
if $R_A=R_1\ .\ k/(1-k)$, there is no distortion due to magnetising current.

e_r = received e.m.f. (instantaneous).
e_a = applied e.m.f. (instantaneous).
e_1 = e.m.f. at the terminals of the equivalent primary winding after resistance has been eliminated.
R_1 = the resistance of the primary winding plus that of the primary circuit between the points at which e_a is applied.
e_2 is the e.m.f. at the terminals of the secondary winding.
R_A is the added resistance.
k is the ratio of transformation, less than 1.
i_1 is the primary instantaneous current.

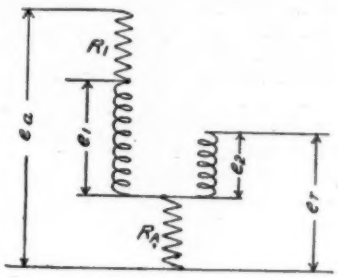


Fig. 8.

Thus we have, considering instantaneous values:—

$$e_1=e_a-i_1\ R_1-i_1\ R_A \quad \ldots\ldots(1)$$
$$e_2=k\ .\ e_1 \quad \ldots\ldots(2)$$
$$e_r=e_2+i_1\ R_A \quad \ldots\ldots(3)$$
$$=k\ .\ e_1+i_1\ R_A \text{ from (2)}$$
$$=k\ .\ (e_a-i_1\ e_1-i_1\ R_A)+i_1\ R_A \text{ from (1)}$$

and $e_r=k\ .\ e_a$ at every instant
if $k\ (R_1+R_a)=R_A$

i.e., if $R_A=R_1\ .\ k/(1-k)$, and e_r is independent of the magnetising current, no matter what the wave-form of the latter may be. Even if a small load is taken on the secondary side, still the iron in the circuit will have no distorting effect; the primary and secondary leakage reactance, and the extra resistance will cause voltage drops, so this form of potential transformer has its disadvantages. Where, however, the secondary load is negligible (or even then, if the impedance of the load is constant), such a form of coupling, where $e_r=ke_a$ always, might, conceivably, be extremely useful.

In conclusion, the author's thanks are due to Mr. J. H. Warburton, B.Sc.(Hons.), for assistance in the preparation of this article.

The Status of Selected and Non-selected Stations.

At our request, the author explains the advantages and disadvantages of "selection" by the Central Electricity Board.

By H. M. SAYERS, M.I.E.E.

THE Electricity (Supply) Act, 1926, defines "selected stations" as "stations at which electricity shall be generated for the purposes of the Board," as named in the Scheme relating to the area in which they are situated. They may be existing stations or proposed new stations. Non-selected stations are not defined; generally they are the other stations of authorised undertakers in the area.

It is convenient to consider the status of these two classes separately, taking selected stations first. It will save space to use the words "selected station" as including the owners of a selected station, and "retained output" for that output required to meet the obligations of the owners to supply within their own areas of supply or under existing contracts for bulk supplies to other undertakers.

The Act puts upon the owners of selected stations certain obligations. Stations are to be worked under the "load dispatching" control of the Board. They are to sell their whole output to the Board on terms defined in the Second Schedule as the "costs of production"; they are to be altered and extended first, as may be required by the scheme; secondly, as the Board—with the approval of the Electricity Commissioners—may direct; and they are to operate with due regard to economy and efficiency. Failure or disability to fulfil these obligations may be visited by the compulsory expropriation of the station at a price which may be roughly described as "cost less depreciation."

In return for the discharge of these obligations, selected stations get certain advantages. These may be summarised as: first, security for the capital and standing charges attributable to the station, which are to be debited to the Board as parts of the "costs of production"; secondly, minimum rates—as compared with those charged to other undertakers—for the "retained output" or the possible output of the station required for its own purposes.

The first item is covered by the provision that the Board has to pay (or credit to) the station, besides the "running charges," the "fixed kilowatt charges," components of the "costs of production," the whole of such costs being defined in the Second Schedule. These include capital charges. In the case of a muni-

cipally owned station, these charges are interest at the average rate payable on the loan capital expended on or attributable to the station and the plant therein, including money out of revenue so spent, and working capital, plus an amount equal to the sinking-fund charges on the borrowed capital and depreciation on the capital expenditure out of revenue. In the case of a company-owned station, the charges are an amount of not less than 5 per cent. nor more than 6½ per cent. per annum on the station capital, plus depreciation on a scale to be prescribed by special order.

The interest rate will depend upon the average rate of interest and dividends paid by the company on its whole capital in the preceding year, if that average rate was over 5 per cent. If it was less, the Board will credit 5 per cent.; if it was more than 6½ per cent., the Board will credit that rate; if it was between those limits, the Board will credit the actual rate.

The scale of depreciation has to be fixed by the Commissioners. It may be expected that they will adopt rates based on the economic life of the various classes of assets, corresponding to the regulation loan repayment periods fixed for municipal undertakings.

The first advantage then is that the owners of a selected station are sure of the capital charges on the station, as well as other standing charges which are independent of output, whether the Board uses the station as a "base-load" station with a high load-factor and large output, or a peak-load or stand-by station with a low load-factor and small output. As a selected station cannot cease to have that status without the consent of the owners, this is a permanent condition. But it may be assumed that in the event of a station being permanently shut down, the extinction of the capital liability by loan repayments or depreciation would terminate the Board's liabilities under this head. This provision should facilitate the raising of capital to carry out extensions and alterations required by the Board, and ease the burdens of the owners of selected stations which may become economically out of date.

The Board will also credit the selected station with the whole of the running charges. It buys the whole output at cost price, including the capital and standing charges. It also decides, by its control, what the output shall be. Its obvious aim will be to use that control to make the overall generating costs in the area a minimum, which may not mean that the generating costs of a particular station are the minimum which would result from running it at the most economical output and load-factor.

The second item of advantage is the price to be paid by the station for that part of its output used for its own consumers, which may be called the retained output. For this part it is to pay cost price, *viz.*, at the same rate as the Board credits it with for its whole output, plus an addition for the Board's administrative expenses. The "same rate" means at the same rate on a "load-factor" basis. The "costs of production" will be split into a "fixed-kilowatt-charges component" and a "running-charges component," and the station will be debited for the retained output at those rates. The Board's administrative expenses are at present an unknown quantity; the official estimates of them shown, *e.g.*, in the "Supplementary Particulars" to the S.E. England Scheme, are quite low. Evidently this cost price may result in a greater or smaller overall rate per unit than the overall cost per unit of the whole output, for the retained output may have a higher or a lower load-factor than that of the whole output.

The energy purchased on this cost-price basis cannot exceed the amount produced by the station, so that this basis applies only where a station is so controlled as to produce at least its own requirements.

It will be noticed that by this primary provision the station is debited with the fraction of fixed kW charges corresponding to its maximum demand for the retained output, including that proportion of the capital charges. It is relieved of capital charges to the extent that the maximum demand of the whole output exceeds that of the retained output.

There are provisions to prevent a station being penalised in costs by its selected status. For example, a station may be so circumstanced that its own costs of production are higher than the rates charged by the Board to non-selected stations in the area. In that case it cannot be charged more than the area rate. This is likely to happen only temporarily, for clearly the Board will not operate a station with costs above the average longer than it must.

Again, as a general provision, the rates at which the station's output is debited to the Board and the retained output debited to the station may be settled by agreement, instead of by the somewhat complex and possibly contentious method of computing the costs of production for each year. It may be expected that this method will become common when conditions are stabilised, if the Board and the owners are both reasonable.

A further safeguard for the station is that the Board may not charge the station more for the whole of the supply furnished to it—including the retained output and anything necessary to supplement it—than it would have cost the station to generate the whole of its requirements. This means that up to the output within the station's capacity, the owners are not to pay more than the costs they would have incurred if they had been left to work independently.

It will be seen that these provisions are likely to work out differently in different cases. A selected station operated as a base-load station at a high load-factor will generally have an output in excess of the retained output. The costs of production will be relatively low, and will be reflected in the rates charged for the retained output, modified by the respective load-factors. As the Board will naturally use the most economical stations as base-load stations, their owners will retain the benefit of possessing economical stations. A selected station operated by the Board as a peak-load or stand-by station will have relatively high overall costs—much higher than if it were run on its own independent load. But the Board may not charge the owners more for their whole supply than it would have cost to generate it at their own station; or, the regular area tariff, whichever is the lower. Similarly if a selected station is permanently shut down.

Illustrations of the way in which it is officially estimated that these provisions will work out may be found in the South-East England Scheme "Supplementary Particulars," taken up to the year 1934. There will be found cases where the "costs of production" debited to the Board work out at several pence per unit of the output, but the rates charged by the Board to the owners work out at less than six-tenths of a penny per unit—for a much larger quantity, naturally.

For the requirements of the owners of selected stations in excess of what such stations could have produced, the owners are in the same position as regards rates as other undertakers supplied by the Board.

Non-selected stations are in some ways more independent. They may continue to work supplying their own areas, with no control from the Board, until certain eventualities arise.

In the first place, they may see that the Board's tariff is below their own generating costs, and may apply to the Board to give them a bulk supply. If they ask for their whole supply, the Board is bound to give it them directly or indirectly, but it may make additional charges where the giving of such a supply entails unreasonable expense for transmission lines, &c.

If, however, they ask for a partial supply to supplement the output of their own station, the Board may decline, offering instead to furnish the whole supply. It cannot impose this condition unless it is satisfied that the cost per unit to the undertakers will be less for seven years than the then cost of generating the supply at the undertakers' own station, leaving out the

capital charges on the station. In other words, the cost of supply by the Board must be less than the total cost of supply from the station including the capital charges thereon. If the undertakers do not agree this, they can appeal to the Commissioners, and beyond them to a barrister from the panel set up under the Act.

This provision seems to be intended to bar non-selected stations from taking supplies from the Board merely for peak-loads; but the Board's normal load-factor tariff will also tend to discourage such applications.

Another eventuality is that the Board may tender to an authorised undertaker a supply for the whole requirements for not less than seven years at the area tariff, being satisfied that the cost to the undertaker will be less than the then cost of generation at the undertaker's station. If the undertakers refuse the offer, the Commissioners may order the undertakers to take the Board's supply and to shut down their own station. Again, the capital charges on the station are left out in comparing the respective costs, and there may be an appeal to a member of the panel. These two provisions constitute the only compulsory powers under the 1926 Act for the shutting down of uneconomical stations. But the Commissioners, under the 1919 and 1922 Acts, have some indirect coercive powers which tend in the same direction. A generating station cannot be erected or extended by an authorised undertaker without the Commissioners' consent, and the Commissioners may refuse consent if satisfied that the required supply can be obtained more economically from another source. Hence the owners of a non-selected station faced with a growing demand and desirous of extending their station or providing a new one, may have consent refused on the ground that the Board's supply is available and will be cheaper.

These coercive provisions are not likely to be exercised if the Board is able to make its tariffs attractive. They may be regarded as a "big stick" for the recalcitrant whose obstinacy stands in the way of the consumer getting the cheapest possible supply.

The Board's general tariff will necessarily include transmission costs. These will not fall upon the owners of selected stations up to the supply which those stations are able to provide. They will fall upon the owners of non-selected stations. Also the owners of selected stations will retain in some measure the economical advantages pertaining to those stations.

As regards the Board's general tariff, that is to be generally a two-rate—kW and consumption rates—tariff. Some other form may be adopted with the approval of the Commissioners.

It hardly needs emphasising that the chief hopes of reducing the cost of generation by the work of the Central Board depend upon its success, first, in using and extending existing resources in the most economical way to reduce working costs; secondly, in reducing the present disproportionate amount of spare plant in generating stations, to reduce capital charges.

Some questions have been raised as to the position of non-statutory undertakers under the Act. They are not mentioned in it. Generating stations belonging to railways, docks, &c., or private generating stations, may be named as selected stations, and these have the corresponding duties, rights and status. It does not appear that any such have been named in the schemes hitherto published. Also the Board may, by agreement, purchase surplus electricity from water power, waste heat, &c., but the stations concerned obtain no special status.

As to undertakers and distributors supplying electricity without statutory powers, they have no right to require a supply from the Board, and the Board has no specific power to supply them. It may—with the consent of the Commissioners—supply electricity for "power" purposes to anyone in an area not forming part of the area of supply of any authorised undertaker, but the wording seems to exclude power to supply an unauthorised undertaker for general distribution. If, however, such an unauthorised undertaker is taking a bulk supply from an authorised undertaker, there is nothing in the 1926 Act to interfere with the continuance of the supply, even if it becomes an "indirect" supply from the Board. Whether the supply is otherwise legal or illegal does not seem to be affected by the Act of 1926.

What to do at Stocktaking Time.

By M. L. HARGREAVES.

WITH prices still fluctuating and taxation still at a high figure, it is imperative that great consideration should be given to the manner in which your stocktaking is performed.

In some businesses it is a very slovenly performance carried out as if it were something very unimportant and to be got out of the way as quickly as possible; it is indeed often performed by a member of the staff who does not know much about the technical side of the trade.

In computing profits it is obvious that a correct stock valued on fair lines is the backbone of such computation, otherwise your book-keeping, however elaborate it may be, is useless.

Many stock books and sheets never contain the necessary data required for the purpose of checking the stock which should, of course, be done by one of the firm and/or by an accountant, the latter's check being obviously more of a mathematical check than a technical one. It ought to be possible for the stock sheets to be taken up and at a glance to see from whom the various items were purchased, date of invoice, quantity, price, &c.

Very few stocks are thus tabulated, and only contain meagre details. No hard-and-fast rule can be laid down for any particular line of business, but in any event the following should be carried out by any firm of size and repute:—

(1) Each stock sheet or book should be certified by the person who took the stock;
(2) also certified by the person who extended the stock;
(3) also certified by the person who checked the extensions and additions; and
(4) it is essential that the person who takes stock shall have some technical knowledge of the business.

In the larger firms who employ either auditors or accountants, it would be wise to show all references to invoices, with names and dates of purchase which will save endless time in tracing prices which require verification. The illustration shows exactly what is required in this connection.

STOCK BOOK OR STOCK SHEET RULING.

Particulars of reference.	Person from whom purchased.	Date.	Particulars of goods.	Quantity.	Price.	£ s. d.	Remarks.

In the price column, if a certain class of goods is

taken at cost price, it should be entered in black ink. but if at a lower one, owing to market conditions, the entry should be in red and marked "M.P." (market price), indicating that the goods have been valued at the market price ruling at the date of stocktaking in place of cost price. If there were any goods taken into stock which were damaged or considered to be otherwise unsaleable for some reason or other, and no value is placed thereon, then the price should be marked "N.V.," signifying no value; this is a much better plan than leaving such stock out of the stocktaking record altogether.

It is also of extreme importance that all stock other than the ordinary trading stock should be kept quite separately; this may come under any of the following heads, for example:—

(1) Advertising matter.
(2) Receipt books.
(3) Petrol.
(4) Stationery.
(5) String, wire, &c.

There is also another important point to be considered, *viz.*: Goods which may have been ready for dispatch during the last few days of the financial year, but were not delivered until the following month, *i.e.*, were omitted from stock being packed for delivery in the *old year* and for inclusion in the sales of the *old year*, should be included in the stock by copying the entries from the sales day book in the *following month* in respect of these goods, and deducting therefrom a certain percentage to reduce the goods to cost price. On the contrary, if it so happened that the goods had been included in the sales of the old year, but not cleared from the premises, then obviously these goods *must be excluded* from stock.

In conclusion, there is an important point to be watched, and that is to ascertain that all the goods which have been *bought* and for which invoices have been received and entered up in the purchase book, are included in the stock, whether the goods have arrived or not; or to deal with this matter in another way, to leave out of the purchase day book all invoices for goods purchased *before the end of the year which were not delivered until after the end of the year*, the latter practice being the best method to adopt.

The Engineer's Leisure.

Does he spend it to the best advantage?

By H. R. TAUNTON.

THE little article by "S." in a recent issue of the Electrical Review—"A plea for greater interest in literature on the part of technical men"—suggests a wider topic: what might be called "A plea for greater interest in life on the part of all business men." You think it perhaps unnecessary to plead with anyone to take an interest in life? You point to the obvious fact that everyone alive is supremely interested in remaining alive. Very true. But as much can be said of a sheep or a slug or a sea-anemone, whose only interest in life is an instinctive avoidance of the end of it. In what does the existence of many business men differ from theirs but that to their animal instincts they have added a few habits, to smudge the pattern of their monotonous days?

Look round upon your friends and wonder how few of them are really *alive*: are enjoying a tithe, are even aware of a tithe, of the delights of a full life. A, the manager, wakes to a scrambled toilet and an ill-digested breakfast, uneasy until he can plunge into the daily routine of his works. Routine sends him home again at evening, and the few hours that are left to him before he goes to bed are almost as much a matter of routine. His reading is technical, his conversation "shop," the most of his acquaintance engineers who do and talk and think as he does. B, the station chief, spends what time he is not at his office in worrying about his generating costs. He has a switch under his pillow and a tablet by his bedside, to jot down anything which may occur to him during the night for their decimal improvement. (He suffers from insomnia.) His hobby is collecting the statistics of other stations. C, the contractor, habitually works overtime, and his every waking moment is haunted by anticipation of a loss on this or that contract. The lawyer boasts—boasts, mind you!—that every night he takes home the papers of his latest case and shuts himself up with them till midnight; the doctor tells you that he has no time for other reading than the "British Medical Journal" or the "Lancet"; the banker and the stockbroker spell life with an "£."

All of them—engineers and professional and business men—in reality taste of life no more than does a vegetable, which breathes and feeds and presently withers in its season. The advantage, indeed, is with the vegetable: rooted in the open, at least it enjoys the simple pleasures of the sun and the wind; while the man, with deadened senses, stumbles along the rut in which his feet were first placed by circumstance. More exactly, his rut is a deep trench—"revetted," it may be, with blueprints or briefs or invoices—along which he is content to creep, mole-like, from cradle to coffin, without a glimpse of the pleasant pastures on either hand. He never thinks to climb out into the wonderful world to which he was born, nor even to raise his eyes to the blue of heaven. And yet, put the question to him, and he will stare and say, "Of course I am alive!"

Such as he are no more alive than is the pit pony toiling timelessly in the dark of the mine, or than the galley slave chained to a hopeless bench. Professional and business men, clever, rich, "successful," they drag unsuspected shackles, slaves to their work. They do not so much live as work a passage through life. They do not realise it; indeed, so insensibly have they riveted their own fetters, so long have they worn them, that, like the prisoner in the old story, they would be wretched without them. They are content, because the one obsession of their work has killed their imagination, and dulled their perceptions to the thousandfold delights which life would offer them. They are "happy," only because they know not what they miss of happiness.

Unaware, they have gradually drifted into a monstrous inversion of the means and the end. Life is more important than work, and—peace to the shade of Samuel Smiles!—he who makes the one synonymous with the other is as a man who, coming into a rich heritage, should spend his days in counting it instead of enjoying it. To paraphrase the old law, we do not live to work, we work to live. In the beginning, work had no other aim. The simple man worked no more than was needful to gain his simple pleasures. In our more complex days, he has to work, not only for himself and his dependents, but for the community. To go further and to work for the mere sake of working, to toil unremittingly so that no time is left to enjoy the fruits of toil, is but the pathetic futility of the labouring ass, who lives and dies in blinkers.

It is only in the higher ranks of the working hierarchy that this perversity is common. The workman, the shopgirl, the clerk, the typist, work their allotted

hours, and at their end forget them till the morrow. They abandon themselves to their leisure with whole-hearted zest and, with a tithe of their employers' means, get from it tenfold the savour. They are the wise, the true economists. To be sure, they are unfettered by responsibility or that sense of duty which—on occasion—makes of the slavery of the engineer or the scientist an honourable sacrifice. But how often is the sacrifice quite needless! How often is it no more than habit, sheer stupidity, or a sordid grubbing after money!

To blend a couple of Stevenson's sayings, we only pass this way once, through a world full of wonderful things; so that, if we would be "as happy as kings," it behoves us to lose no opportunity of enjoying them. A lifetime of freedom were all too short to taste a scanty measure of the joys life has to offer our soul and our five senses. Since work, however, itself is to the normal man a pleasure—or at least the lack of it an empty misery—and since withal it is commonly a necessity and always a duty, we cannot do better than observe the old rule of "eight hours work, eight hours sleep, and eight hours play." And of these, for the enjoying of a full life, the hours of "play" are the most important; for, after all, "the enjoying of a full life" is as good an answer to the riddle of existence as any at which we yet can guess.

How to make the most of these hours of leisure is a question each must settle for himself. It really matters little how they are spent; what is important is that they are not encroached upon by work, or the thought of work—"work," here as always, in the sense of the day's employment. It is debatable, however, whether "S.'s" suggestion of reading as a change from work is wholly satisfactory. Reading, unless it be of the lightest kind of fiction, demands a mental application too near akin to that of the professional man's working hours to be a true relaxation. To spend one's days between working and reading would be to touch life at two points only: two narrow ruts, close together, instead of one. We want to avoid the ruts altogether; we want to have interests in life, mental and physical, so many and diverse that each of our days adds something rich and colourful to our store of memories. Reading by all means; but also music, art, hobbies, games, social pleasures; anything, so long as it is not work out of working hours; anything, so long as it is different and ever-changing. In defiance of all the copybooks, it is better to do a lot of things, however badly, than one thing, and one thing only, well.

It is a pity we cannot keep that portentous word, Efficiency, out of the argument; but here, at the tag-end of it, we must throw it as a sop to the strenuous hundred-per-centers, trained in the Gradgrind tradition, to whom the suggestion that work is not our sole excuse for existence must sound like a discord in the key of blasphemy. Let them take heart, and be assured that work and play in separate watertight compartments serves their favourite fetish. Who will attack his daily round the better: he who comes to it, jaded by an interval of half-work and worry, dull as the ox to the plough; or he who, with mind and senses sharpened by the zest of life, has learned to look upon his work as another pleasure.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

Unspillable Accumulators.

The development of portable wireless receivers has been accompanied by a corresponding improvement of the batteries. Unspillable under all conditions they must be, since loose acid can quickly cause havoc in any set; further, it is essential that they be compact and of maximum capacity for their bulk and weight. Another, and an important point, which has not received the attention it merited, is the necessity for the plates being permanently covered with acid. The suitcase type of set's battery is frequently in two different positions:

Fig. 1.—A New "Unspillable" Battery.

the carrying position and the working position, at right angles to each other, for long periods. The new "Exide" unspillable battery's plates remain covered with acid whether the cell is stood on its base or on end. The unspillable device consists of a compartment on the top of a portion of the cell (fig. 1), divided into intercommunicating parts, so arranged that it is impossible, in any position, for acid to get out of the cell, and it tends to drain back into the main compartment as soon as the cell is left standing in either of the normal positions. Compactness is assured by the position of the terminals which are on top of the cell, but so placed that no extra height is entailed by the unspillable device. The new type is made by the CHLORIDE ELECTRICAL STORAGE CO., LTD., in sizes of from 8 to 32 ampere-hour capacity.

New Marconi Products.

The merits of a moving-coil loud-speaker driven by a correctly designed receiver are generally appreciated, and if the ideal method of suspending the cone could be devised, full advantage of the basic principle would be obtainable. Silk, leather, or rubber mounting is not infrequently accused of introducing resonance and of being difficult to adjust with the necessary degree of accuracy, whilst climatic changes are

Fig. 2.—New Marconiphone Speaker.

sometimes said to cause sufficient sag displacement of the coil to produce rattling contact with the magnet poles. The MARCONIPHONE CO., LTD., announces the incorporation of a new system of double suspension in its latest moving-coil speakers; it is claimed to allow exceptional freedom of motion axially and to prevent all side play, assuring parallel movement of the coil at all times. Resonance due to suspensory material is avoided, and the edge of the cone is unrestricted, but it

D

carries a high felt ring to prevent circulation of the air waves from one side of the diaphragm to the other. The small air gap reduces the size and weight of the electromagnet, and consequently the field current. The new speakers are available in cabinet form (fig. 2), and also bare (fig. 3) for home assembly in three models—namely, for use with a 6- to 10-volt accumulator, consuming from 0.6 to 1 ampere; and for a.c.

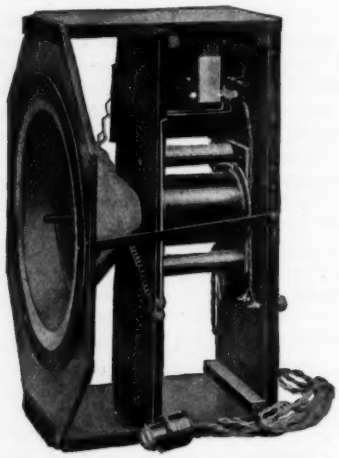


Fig. 3.—Moving-coil System for Home Assembly.

and d.c. mains operation, consuming about 100 mA. These speakers are said to be suitable for use with an average receiver incorporating a standard power valve in the last stage.

Amongst this season's products of the Marconiphone Co., Ltd., is a new model (34) 3-valve short-wave receiver (fig. 4); standard plug-in coils can be used with an adaptor, which makes the set equally useful for broadcast and short-wave reception. It has but one tuning circuit and one reaction adjustment, each with 70 to 1 reduction gear; shielding, together with a system of chokes, not only prevents hand-capacity disturbances, but also adds stability, a feature being that telephones and loud-speaker may be interchanged with little effect on the tuning and reaction settings; this is an advantage, since preliminary tuning is often more conveniently carried out with telephones. Spaced coils wound on skeleton frames are employed, the two supplied with the instrument embracing the principal short-wave stations. Attention has been given to the system of connection, unusually wide knife-blade contacts and spring clips being fitted. Housed in a

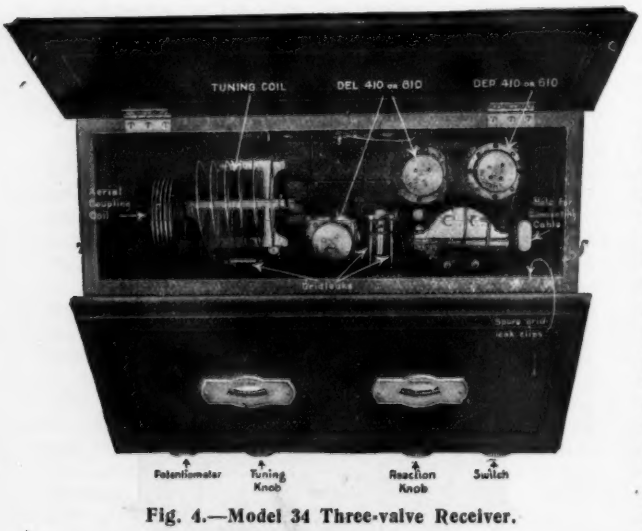


Fig. 4.—Model 34 Three-valve Receiver.

mahogany cabinet with sloping front, all knobs and dials are made of moulded bakelite to match, the latter being set in oxidised escutcheon plates of pleasing design.

This set has been very thoroughly tested, even to the extent of being taken on a voyage to Singapore, during which journey regular reception of 5SW, PCJJ, and American short-wave stations was maintained.

The new Marconiphone "Popular" transformer, ratio 4 to 1, while being in the lower-priced category, is nevertheless capable of functioning excellently. Its small size and completely reversible feet will make it very useful for portable and other receivers where space is limited.

Legal.

Action by P.M.G. Dismissed.

The *Daily Telegraph* reports that at Portsmouth County Court, on August 16th, the Postmaster-General claimed damages from William Latter, licensee of the King's Head, Wickham, for injury to telegraph wires consequent upon a fire at his premises in October last, caused by the defendant falling on the stairs while carrying a paraffin lamp. The heat from the fire reached the telegraph wires in front of defendant's premises. It was contended that the lamp was dangerous.

The Judge said that if the Act applying to the case did not protect a man when simply carrying an ordinary lamp, it seemed to him to be a farce. He dismissed the action with costs, but gave leave to appeal.

Theft of Cable.

A Perth labourer was fined £5 with the alternative of 30 days' imprisonment when he admitted stealing from an office occupied by Callender's Cable & Construction Co., Ltd., 70 lb. of copper wire and 112 lb. of lead. For the accused, who was in the employment of the company, it was explained that the copper and lead were the ends of the cable which were cut off after the main cable had been laid, and he was under the impression that he was entitled to take these scrap ends. The prosecutor described the case as one of deliberate theft.

British Thomson-Houston Patents.

In the Vacation Court, on August 15th, Mr. Justice Charles had before him a motion to continue until the trial of the action or further order an *ex-parte* injunction obtained by the British Thomson-Houston Co., Ltd., restraining J. Solomon and Sons and S. Solomon from infringing plaintiffs' patent for gasfilled lamps.

It was alleged that J. Solomon & Sons were selling as principals and S. Solomon as their agent, gasfilled lamps that were manufactured in infringement of the plaintiffs' patent.

Mr. J. Solomon, who appeared in person, admitted that he had not entered an appearance to the writ, but declared that his lamps were not an infringement of any patent.

His Lordship: That will be fought out when the action is tried. Very strong evidence has been put before me that your lamps are an obvious infringement of the plaintiffs' patent.

Mr. Solomon said that Mr. S. Solomon was carrying on an entirely different business, and was not his agent.

His Lordship: There will be an injunction until the trial of the action or further order restraining you from dealing with these lamps, and the matter will then be tried and decided, and if it turns out that you are right, I make an order that the plaintiffs are liable to you in damages because of the injunction granted against you.

Safety First in Industry.

Forty-five countries were represented at the important international Conference dealing with the prevention of accidents in industry, which recently completed its discussions at Geneva under the auspices of the International Labour Organisation. Each country as a rule sent four delegates—two representing the Government and one apiece the workers and the employers, together with a number of technical advisers. A full report has been published by *Safety First*, the official organ of the National Safety First Association, in its issue for June-July. The following decision was reached: "The Conference is of opinion that the time has come to attempt to reach a higher standard of safety by the development of new methods, and believes that the greatest advance can be made on the lines of the movement which has received the name of the "Safety First" movement, and which implies in its application to industry (*a*) the recognition of accident prevention as an essential part of the organisation of the works, and (*b*) common interest and endeavour on the part of employers and workers in the individual works in seeking to promote a higher standard of safety. It is essential that the management officials and foremen in the individual works should foster throughout the works a due appreciation of the necessity of avoiding accidents, and that all possible steps should be taken to interest the workers in the work of accident prevention. The safety organisation in a works should include, among other methods, arrangements for a works investigation of every accident occurring in the works, and the consideration of the methods to be adopted for preventing a recurrence; the systematic supervision of the works, machinery and plant for the purpose of ensuring safety, and, in particular, of seeing that all safeguards and other safety appliances are maintained in proper order and position; the explanation to new, and especially young, workers of the possible dangers of the work or the machinery or plant connected with their work; the organisation of first aid and ambulance arrangements; and the encouragement of suggestions from the persons employed for rendering work safer.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Electrical Trade Exhibition in New York.

Electrical contractors, wholesalers, retailers and buyers of electrical goods, and all others engaged in the business of distributing and supplying electrical appliances throughout the United States, will have a trade show in New York City in October, where there will be assembled and demonstrated the thousands of approved electrical devices used in the modern home. It will be held on October 17th, 18th and 19th in the Grand Central Palace. It is claimed to be the first trade show of its kind ever held, but it is not entirely a new venture, as it has behind it the accumulated experience of 20 annual shows of the Electrical and Industrial Exposition. Mr. Arthur Williams, vice-president in charge of commercial relations of the New York Edison Company and president of the Electrical and Industrial Exposition, says that the trade show is an expansion on a national basis of the annual electrical show, with the first three days set apart exclusively for the trade, and the final seven days open to the general or consuming public. The decision to expand the annual electrical show into a trade show on a national basis was made in response to recommendations and suggestions from important factors in the electrical industry. In the past the annual shows have been primarily consumers' shows, and trade shows only to the extent that they were attended by dealers and others in the trade from the metropolitan New York area and nearby cities. Now, with the co-operation of manufacturers and others, it is planned to make three days of the show exclusively a trade show for the convenience of dealers, who will survey the entire field of electrical household devices, meet the manufacturer or his responsible representative face to face, and generally acquire information and knowledge that will be of service to them in the conduct of their own local business.

American Transformer Business.

It is announced in the *Electrical World* that the transformer division of the Packard Electric Company, Warren, Ohio, has been purchased in its entirety by the American Brown Boveri Electric Corporation. The Packard Company, in its transformer division, has made a wide range of transformers in its plant at Warren, Ohio, for the last 38 years. These transformers will be continued in all types and sizes under the established trade mark "Packard." The American Brown Boveri manufacturing and engineering facilities will be consolidated with those of its other departments at the Camden, N.J., plant.

"End with the Love."

We are permitted by Messrs. Johnson & Phillips, Ltd., to reproduce the following from a Gold Coast correspondent. So beautifully expressed and affectionate a testimonial must have brought blushes to the Charlton cheeks:—

"Dear Sir,

"Your name and address has been highly recommended to me by a well friend of mine, that you are the best dealer in the city of London. Therefore I am here to-day, to ask you, one of your famours Catalogue so that it will enable me to deal you with you, as I am anxious to order some goods from you. Hoping to have same per the returning mails.

"End with the love,

"I am,

"——."

A Budapest Inquiry.

The Commercial Secretary at Budapest (Mr. H. N. Sturrock) reports that a local firm desires to be put into touch with British manufacturers of small portable hand-driven electric generators for wireless purposes. British makers should apply to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. (Reference B.X. 4645.)

More Merchandise Marks Inquiries.

It is announced that inquiries will be held later on, under the Merchandise Marks Act, 1926, concerning whether the following classes and descriptions of imported goods should bear an indication of origin: Rubber manufactures; vacuum cleaners; glassware; wireless receiving sets, components, and accessories. Communications should be addressed to the Secretary, Mr. E. W. Reardon, Board of Trade Offices, Great George Street, S.W.1.

Sub-station Probationers' Wages.

The Industrial Court met on July 18th last to determine whether the rates laid down for probationers in Section XX of Clause 7 of Award 2773 of the Committee on Production dated November 8th, 1918, as subsequently amended by agreement between the Railway Companies, the Electrical Trades Union and the National Union of Railwaymen dated July 20th, 1927, should be based upon the percentage of the actual rate of the assistant sub-station attendants employed at the particular station to which the probationer is attached, or of the minimum rate of assistant sub-station attendants scheduled to the agreement. As a result the Court ruled that the provisions of Award No. 2773 in regard to the wages of probationers employed as assistant sub-station attendants contemplated a uniform rate for such probationers, and not a rate varying with the kW capacity of the station in which they might be employed. It follows that the minimum rate to which the percentages referred to were applicable was that for assistant sub-station attendants employed in sub-stations with a capacity of less than 3,000 kW. So far, therefore, as the agreement of July 20th, 1927, is concerned, the Court rules that the term "minimum rate" as used in that Agreement means the rate applicable to sub-stations with a capacity of less than 3,000 kW. The Court is of the opinion, however, that when the agreement of July 20th, 1927, was drawn up its provisions in regard to probationers of less than 18 months' service were entered into by the Union under a *bona-fide* misapprehension as to its true effect, and in these circumstances determines that the agreement, so far as probationers of less than 18 months' service are concerned, should be reviewed by the parties or referred to the Court for a decision.

Irish Free State Electrical Exports.

A return recently issued by the Irish Free State Department of Industry and Commerce shows that electrical goods of the country's manufacture to a value of £1,441 were exported from the Free State during the three months ended March last as compared with £2,942 in the corresponding period of 1927.

Recent Contracts.

The Metropolitan-Vickers Electrical Co., Ltd., has received two very large orders for electric railway equipment for the Southern Railway and the Sydney Suburban Railways of the New South Wales Government. The contract for the Southern Railway is for 72 motor-coach equipments and 58 trailer coach equipments. The electric trains used on the Southern Railway suburban system are made up of train units each consisting of two motor coaches with a trailer coach between. Trains consisting of one, two or three of these units, or eight-coach trains consisting of two-train units with two trailer coaches between, are used as required. The new equipment is required in connection with the conversion of part of the central section (late L.B. & S.C.R.) of the suburban system from single-phase a.c. operation with overhead line to d.c. third-rail operation. The greater part of the conversion is now completed. The present contract is the fifth of considerable magnitude which has been placed with the company for train equipments for the Southern Railway. The new equipment will be similar to that supplied on the previous contracts. Each motor-coach will be equipped with two 275-h.p., totally-enclosed, self-ventilating motors. The motors are arranged in pairs on the bogies underneath the driving compartments at the two ends of the train unit. The control gear is of the Metropolitan-Vickers all-electric type, with automatic acceleration. For the Sydney Suburban Railways the Metropolitan-Vickers Company is to supply 100 motor-coach equipments and 100 trailer-coach equipments. The motors, two for each coach, are units of 360 h.p., probably the most powerful individual motors ever installed for multiple unit trains. The control gear is electro-pneumatic. The electrification scheme of the Sydney Suburban Railways is a very extensive one, involving ultimately more than 400 miles of track, and is bound up with the gigantic new bridge now being built across Sydney Harbour, for one of the most important railway extensions is a new section of line which will pass over the bridge, forming a direct route from Sydney City to the North. The present contract is the fourth placed with the Metropolitan-Vickers Co. for coach equipments, and will bring the total of Metrovick-equipped coaches on this railway to more than 450 of each type. The whole of the electrical equipment for the recent Metropolitan Railway and Southern Railway contracts and the greater part of the equipment for

the Sydney contract, will be manufactured at the company's works at Trafford Park and Sheffield, ensuring work for a large number of employés for the next twelve months. The remainder of the equipment for the Sydney railway contract will be manufactured at the Metropolitan-Vickers works at Sydney.

Among the orders recently received by Messrs. Mirrlees, Bickerton & Day, Ltd., are the following:—Barnstaple Corporation Electricity Works.—A 180-b.h.p. 3-cylinder "Mirrlees-Diesel" engine, coupled to an Electric Construction Co. dynamo. Marconi's Wireless Telegraph Co., Ltd.—Two 220-b.h.p. four-cylinder "Mirrlees-Diesel" engines and Crompton-Parkinson dynamos. These engines are exactly similar to those supplied to the Marconi beam station at Poona in 1925. The Diesel sets will be installed at Marconi's Chelmsford works. Frinton-on-Sea and District Electric Light & Power Co.—After many years of experience with two "Mirrlees-Diesel" engines of 150 b.h.p. each, this company has ordered a 300-b.h.p. "Mirrlees-Diesel" engine. This will be coupled to a generator made by the General Electric Co., Ltd.

Messrs. John Bennie, Ltd., Star Engine Works, Moncur Street, Glasgow, have completed an installation of electric lifts at the new Royal Infirmary, Stirling. Messrs. Bennie have recently received an order for the installation of seven passenger lifts, seven goods lifts, and six service lifts at Canberra, the capital of Australia, and another important contract is the installation of seven lifts in the newly-erected building for Boots, Ltd., chemists, in Glasgow.

Bankruptcy Proceedings.

John Donald Ridley, trading as The Eastern Counties Electrical Constructional Co., 41, Butter Market, Ipswich, electrical engineer.—The public examination of this debtor was adjourned at the Shire Hall, Ipswich, recently. Debtor estimated his liabilities at £860, with a deficiency of £812. It appeared that he had had various situations as an electrical engineer, having been apprenticed to the trade. In September, 1926, debtor applied for registration under the Business Names Act, then having a free capital of £87, which was nearly all spent in equipping an office and buying materials. He did small jobbing work and repairs at the commencement, but, finding too much work, he advertised for a partner. That partner only provided £10, by instalments. Debtor gave him an equal share in the business because he hoped that he would introduce fresh customers. The first contract they undertook was for lighting 62 Council houses, for £360. Debtor supervised the job, and shortly after they got another contract for £1,193, and his partner was left in charge of that one. They lost money on the second contract, and paid for their materials as they received money for the job. Debtor said they employed 10 to 15 men, and in March last he was sold up, and he expected the goods to have made £40, but they only realised £13. Debtor agreed that from October to March he lost £1,147, and he could not account for it. The debtor was ordered to file deficiency and trading accounts.

G. B. Banks (Redditch Radio Co.), radio engineer, 16, Market Place, Redditch.—The following scheme or composition sanctioned by Court.—Preferential debts to be paid in full together with all costs, charges and expenses. A composition of 13s. 4d. in the £, to be paid to all unsecured creditors (claim of debtor's father to be withdrawn). Receiving order dated June 15th, 1928, discharged. Last day for proofs for dividend, September 3rd. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham.

W. Barraclough, radio dealer, &c., 45, Owston Road, Carcroft, Yorks.—The first meeting of the creditors was held on August 16th, at the Official Receiver's offices, Sheffield, when the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate. The unsecured liabilities amounted to £255, with a deficiency of £195. Debtor attributed his failure to unemployment and lack of business.

P. F. Brittain, formerly of East Down Works, Dermody Road, Lewisham, &c., electrical engineer.—Last day for proofs for dividend, August 30th. Trustees, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., and Mr. J. H. Hodson, 69, Basinghall Street, E.C.

J. Turner, electrician, 62, Blackburn Road, Great Harwood.—Trustee, Mr. J. P. Duxbury, 27, Richmond Terrace, Blackburn, released July 26th.

J. H. Painter (Venables & Co.), electrician, 99, The Broadway, Cricklewood, N.W.—Bankrupt's discharge suspended until July 10th, 1931.

S. S. Kelly, electrical contractor, 59, North Road, Durham.—Trustee, Mr. H. J. Armstrong, appointed August 8th, 1928.

B. E. M. Pook, wireless dealer, 60, Chelsea Road, Southsea.—Receiving order made August 13th, on debtor's own petition.

Company Liquidations.

Hungerford & District Electricity Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. G. Cox, 7, Duke Street, Adelphi, W.C.

A meeting of the creditors was convened for August 15th at 7, Duke Street. The liquidator of the company, Mr. Alfred G. Cox, explained that it was anticipated that all the creditors would be paid in full and that the company would be wound up at the earliest possible moment. No discussion took place, and the matter remains in the hands of the liquidator.

South American Light & Power Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. C. H. Lambert, River Plate House, Finsbury Circus, who is authorised to consent to the registration of a new company to be called "The Argentine Industrial Co., Ltd." Particulars of claims to the liquidator, by September 11th.

Electric Furnace Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. A. A. White, 17, Victoria Street, S.W., who is authorised to consent to the registration of a new company to be named "Electric Furnace Co., Ltd." Particulars of claims to the liquidator by September 24th.

Deed of Assignment.

H. Thwaites, radio and electrical engineer, trading as the Astral Electrical Co., 41, Market Street, Marple, Cheshire.—Messrs. Harry L. Price & Co., 47, Mosley Street, Manchester, state that this debtor is unable to continue business, and has executed a deed of assignment to Mr. A. T. Eaves as trustee. The statement of affairs discloses liabilities of £171, due to unsecured creditors. There are net assets of £80, leaving a deficiency of £91.

Trade Announcements.

Messrs. A. J. Coleman & Co., electrical and radio wholesalers, of Northampton, have removed their business to larger premises at 37 and 39, The Arcade.

Messrs. A. H. Roper, Ltd., have opened new electrical showroom premises at 139, Shirley Road, Croydon.

The Cape Town branch of the British General Electric Co., Ltd., has been moved from Castle Street to the corner of Lower Berg and Riebeek Street, Cape Town.

All goods and correspondence for the Magicoal Fire Co. should in future be addressed to Wembley Hill (Exhibition Ground), Middlesex. Telephone: "Wembley 3201-2."

Owing to extending business in the West of England, Messrs. Philips Lamps, Ltd., have removed to 16, Temple Street, Bristol (telephone Bristol 4907-4908), where they will hold larger stocks.

Book Notices.

"Chromium Plating."—This well illustrated booklet, issued by Messrs. W. Canning & Co., Ltd., 133-137, Great Hampton Street, Birmingham, gives much information on the general uses of chromium plating, and should be particularly useful in view of the very wide field it covers. There is hardly a phase of industry now which the treatment does not touch.

"Signal Strength Measurements of 3LO Melbourne," by R. O. Cherry, M.Sc. Papers I and II, recording the results of investigations made under the direction of Prof. T. H. Laby, Sc.D., at the University of Melbourne, with the aid of a gift of £500 per annum by the Broadcasting Company of Australia for the encouragement of radio research.

"The Lineman's Handbook," by E. Kurtz. Pp. ix+547; figs. 603. London: McGraw-Hill Publishing Co., Ltd. Price 20s.

McGraw-Hill Books on "Transportation."—This catalogue, No. 12, contains a list of all the books on aeronautic, automobile, marine and railway engineering, published by the McGraw-Hill Publishing Co., Ltd., 6, Bouverie Street, E.C.4, and will be sent free upon application.

"*Journal* of the Institution of Electrical Engineers," Vol. LXVI, No. 380. August, 1928. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

The Trade of Barbados.

Reporting on the trade situation in Barbados H.M. Trade Commissioner in the British West Indies (Mr. J. L. Wilson Goode) states as a result of a visit in June that concurrently with an exceptionally large sugar crop, a good deal of money is in circulation and the storekeepers of Bridgetown have little or nothing of which to complain. Where foreign competition is most pronounced is in the hardware stores: but whilst competition in former years was chiefly American it is now largely Continental. There is a good demand for English chinaware and earthenware, but the low prices for German enamelware have attracted most of the storekeepers and they have large stocks on hand. America still leads in electrical apparatus and has almost the entire trade in gramophones and steel cabinets. United Kingdom trade in glassware has declined very much whilst the trade of America and Germany, particularly the latter, is increasing. Supplies of rubber goods are still drawn chiefly from the United Kingdom, but the demand for certain rubber articles of Canadian manufacture is well maintained. The demand for certain classes of machinery has been stimulated by the construction of the new water works at Belleville which are nearing completion. The machinery for these works has been supplied by manufacturers in the United Kingdom.

New Belgian Company.

La Société d'Electricité de Bressoux et Extensions is the name of a new company which has been formed in Brussels with a capital of three million francs.

Encouraging the Use of Electric Vehicles.

With the object of encouraging and facilitating the use of electric commercial vehicles, the New York Edison Co. is now supplying consumers with battery charging plant for electric vehicles on the hire-purchase system. Under this scheme the

consumer can select the kind of charging board and equipment desired, and it is installed under the direction of the engineers of the New York Edison Co., payment being made in twelve monthly instalments along with the monthly remittance of the company's bill for the supply of electrical energy. No interest or other charges are added.

Social Events.

On Saturday, August 11th, the Pirelli-General Cable Works Social and Sports Club held its annual sports gala on the sports ground at Eastleigh. The weather was ideal, and over 500 members attended. The most important event of the day was the deciding of the Inter-Departmental Championship for the Railing Cup—the cup being won by the Department gaining most points in eight championship events, comprising the following: Throwing the cricket ball, 220 yards flat race, 50 yards dash, putting the shot, broad and high jumps, relay race, and the inter-department tug-of-war. The Plant and Maintenance Department of the Southampton factory were the successful entrants, with a total of 25 points, the Administration Department (also of the Southampton factory) coming second with 10 points. There were a number of additional events and competitions. Tea was provided in large marquee tents and in the sports pavilion, and two tennis tournaments followed. At 9 p.m. Mr. Martinez, director and general manager of the company, also chairman of the club, presented the prizes, and the Martinez Cup, for inter-departmental cricket, won by the P. & M. Department, Eastleigh, together with medals presented by Mr. Giffen, head of this department. A dance was held in the pavilion, music being provided by the Works Dance Orchestra. At the close Mr. A. E. Greenhill, vice-chairman of the club, called for three cheers for Mr. A. C. Woodley, secretary and treasurer.

The twelfth annual horticultural exhibition and garden party of the "Clesco" Sports and Social Club will take place on Saturday, September 1st, from 2 p.m. onwards, at "Clesco" Sports Ground, Grand Drive, Raynes Park, S.W.

The annual outing of the staff of Messrs. A. H. Hunt, Ltd., of Croydon, was recently held. The party, which included the country travellers, assembled at the works and journeyed by charabancs to Brighton. Lunch was served in the Masonic Room of the Royal Pavilion, Brighton. Presentations on behalf of the staff were made to Mr. A. H. Hunt by Mr. F. J. Chamberlain, and to Mr. C. H. Hunt by the works manager, Mr. E. A. Baggaley. The gifts actually handed over were desk miniatures of billiard cues, complete with cases, which could not, of course, be taken down to Brighton for presentation. Tea preceded the return journey, and on the way home there was an hour's break at Handcross for a dance and sing-song.

New Catalogues and Lists.

MESSRS. ROBERT CRAIG & SONS (ENGINEERS), LTD., York Street Engineering Works, Great George's Street, Belfast.—Illustrated catalogue dealing with water turbines.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive leaflet No. 790/6—1, containing a reprint of an article on the M-V equipment at the Appleby Iron Co.'s Works, by W. E. Taylor, from the *Metropolitan-Vickers Gazette*.

The ELECTRICAL EQUIPMENT & CARBON CO., LTD., Bank Buildings, 107-111, New Oxford Street, W.C.1.—Booklet illustrating dynamo brushes manufactured by Gebrüder Siemens and Co.

MESSRS. KORTING & MATHIESEN ELECTRICAL, LTD., 711 & 715, Fulham Road, S.W.6.—Illustrated price list of lighting equipment for film and photographic studios.

MESSRS. PHILLIPS & TURNER, Cambridge Street, Birmingham.—Leaflets dealing with cable clips and saddles.

UNITED ELECTRICAL CO. (BIRMINGHAM), LTD., Coolex Works, Caroline Street, Birmingham.—List No. 105, containing illustrated details and prices of "Coolex" switch- and fuse-gear in teak and iron cases.

THE RANSOME & MARLES BEARING CO., LTD., Newark.—An illustrated abridged catalogue of the company's ball and roller bearings. Illustrated and priced.

MESSRS. C. J. HAWKINS & Co., 43, Great Saffron Hill, E.C.1.—A calendar-blotter calling attention to the firm's electrical contracting, &c., service.

MESSRS. CHARLES JOYNER & Co., Icknield Square, Birmingham.—Pamphlet J89, dealing with "Angelus" immersion heaters.

MESSRS. J. R. MORRIS, Imperial House, 15-19, Kingsway, W.C.2.—Folder dealing with Columbia batteries, giving revised prices as from August 20th.

MESSRS. STUART TURNER, LTD., Henley-on-Thames, Oxon.—Booklet describing the firm's ¼-kW house-lighting plant, and giving information on small country-house lighting generally.

Nife Batteries to the Rescue!

According to Mr. Ljunglund, the wireless operator of the aeroplane "Uppland," which went to the rescue of Gen. Nobile, attempts by aeroplanes to provide the stranded party with batteries for wireless signalling all failed until the "Uppland" dropped three "Nife" steel-plate batteries, which survived that ordeal and enabled the party to maintain communication with the rescue parties until the "Krassin" arrived, the batteries operating successfully in spite of the low temperature.

Austrian Electrical Measuring Instruments Exhibition.

An exhibition of electrical measuring instruments is to be held at the State Technical Testing Institute, Vienna, during November and December next. Entries must be sent in by October 1st to the Technische Versuchsamt, 6-8, Michelbeuerngasse, Vienna IX, whence particulars may be obtained.

New French Companies.

A company has been formed in Paris (10, Rue de la Fidelité), with a capital of three million francs and the title La Société Normande d'Electricité Rurale, to supply electricity in the rural districts of Normandy.

With the title "Detectif," a new company has been formed in Paris (36, Rue de Rochechouart), with a capital of 600,000 fr., to install electric burglar alarms, &c.

South African Tariff Modifications.

Recent modifications in the South African Customs tariff affect, *inter alia*, electric irons and electric steam irons for industrial purposes and switchboxes, the new duties on which are:—Minimum, free; maximum, 3 per cent. *ad valorem*. Filters for power-station purposes, which were formerly subject to a duty of 20 per cent., are to be admitted free of duty.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price August 21st.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£95	...
a	Copper Sulphate ... ... ,,	£95 10s.	...
a	Potash, Chlorate ... ... per lb.	8½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¼d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£95 to £100	...
b	,, Wire ... ... per lb.	1/8 to 1/9	...
b	,, Sheet ... ... ,,	1/8 to 2/0	...
p	Babbitts Metal and Anti-friction Metal—		
	Grade I ... ... per ton net.	£198	...
	Grade II ... ... ,, ,,	£185	...
	Grade III ... ... ,, ,,	£78	...
c	Brass (rolled metal 2" to 12" basis) per lb.	9¾d.	...
c	,, Tubes (solid drawn) ... ... ,,	11½d. to 1/-	...
c	,, Wire, basis ... ... ,,	9¼d.	...
c	Copper Tubes (solid drawn) ... ,,	1/1½	...
c	,, Bars (best selected) ... per ton.	£94	...
c	,, Sheet ... ... ,,	£94	...
c	,, Rod ... ... ,,	£94	...
d	,, (Electrolytic) Bars ... ,,	£69 5s.	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£79 5s.	...
d	,, ,, H.C. Wire per lb.	9⅛d.	...
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	6/3	...
h	India rubber, Para fine ... ... ,,	11d.	¾d. dec.
l	Iron Pig (Cleveland No. 3.) ... per ton.	65/-	...
l	,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£23	10s. inc.
g	Mercury ... ... per bot.	£23	£1 inc.
e	Mica (in original cases) small ... per lb.	3d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/9½	...
p	,, ,, drawn bars & rods ,,	1/8	...
p	,, ,, rolled strip & sheet ,,	1/9½	...
p	,, ,, wire... ... ... ,,	1/8½	...
e	Platinum ... ... per oz.	£17 15s.	...
d	Silicium Bronze Wire ... ... per lb.	10½d.	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton.	£299 10s. to £211 10s.	£1 10s. to £2 10s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	2d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dannis & Co.

Reporting on August 17th, Messrs. James Forster & Co. refer to the diversion of 5,000 tons of Colonial lead and some Mexican to the Continent, while afloat, to meet German and Russian requirements. "There is no change in the general condition here. Consumption, particularly in the cable trades, is not up to normal, and the domestic trade is not likely to increase its requirements. The Board of Trade returns for July are again on the surplus side, as the quantity left for home absorption—about 19,000 tons—is more than ample for trade needs. This figure for the seven months, January to July, is equal to 20,288 tons per month."

Unemployment During July.

The August *Ministry of Labour Gazette* says that employment in the engineering industry was slack during July, and showed a decline as compared with the previous month. It was fair in electrical engineering, but remained bad in marine engineering. The percentage of unemployed in the engineering industry rose from 9.0 to 9.5; in the electrical engineering section the proportion rose from 4.9 to 5.1 per cent. In the electrical wiring and contracting industry there was also decreased employment; the proportion of unemployed rose from 8.4 to 9.2 per cent. There was a slight improvement in the electric cable, wire and lamp manufacturing group, in which the level of unemployment fell from 5.6 to 5.4 per cent. The actual numbers of unemployed in the sections referred to were as follows:—Engineering, 92,354 (including electrical engineering, 4,000); electrical wiring and contracting, 1,330; and electric cable, wire and lamp manufacturing, 4,485.

The Marking of Imported Surgical Instruments.

The Standing Committee of the Board of Trade under the Merchandise Marks Act, 1926, has recommended that many classes of surgical, medical, dental and veterinary instruments shall bear an indication of their origin at the time of sale or exposure. It was considered impracticable to enforce marking upon importation.

French Tariff Classification.

The *Board of Trade Journal* for August 16th contains particulars of a number of alterations of classification of goods for French Customs purposes under a protocol to the Franco-German commercial agreement of August 17th, 1927. Several classes of electrical goods are affected by the alterations.

Lighting and Power Notes.

Accrington.—Loan Sanctioned.—The Town Council has received sanction to the borrowing of £10,000 for consumers' sub-station equipment.

Aberdeen.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £51,641 for the following purposes: Buildings, £6,675; mains, £20,080; plant and crane, £24,886. The Committee has accepted tenders for the erection of a new sub-station in the Queen's Road district, amounting to £3,343.

Australia.—Sydney.—According to the *Electrical Engineer of Australia and New Zealand*, the Sydney Civic Commissioners have passed the estimates for the Electricity Supply Department for the year 1928. The income is estimated at £2,466,263, and the working expenditure at £1,517,612, made up as follows:—Management, £269,565; generation, £428,480; distribution, £364,673; miscellaneous, £42,850; electricity purchases, £402,044; stores sale loss, £10,000. The capital charges are set down at £885,796, and sundry charges at £37,210, leaving an estimated surplus of £25,645. The capital expenditure which will be required during the year is estimated at £4,322,666. Of this amount, £2,796,697 will be for the Bunnerong power station. The resources at present available amount to £1,367,500, leaving £2,955,166 to be borrowed.

The New South Wales Railway Commissioners are taking steps to completely re-equip the Ultimo power station, with a view to reducing the generating costs. The present installation comprises 58 small water-tube boilers, 27,500 kW of 25-cycle generating plant and 6,500 kW of 50-cycle generating plant. Tenders have been called for six 100,000-lb. water-tube boilers, and for two 20,000-kW turbo-alternators with condensing plant. This equipment will take the place of the present boilers and 25-cycle plant. Provision is to be made for the installation at some later date of one or possibly two more 20,000-kW units and additional boilers.

Canada. — Hydro-Electric Development. — Plans to generate additional power to meet the growing demand for hydro-electric energy in the Georgian Bay system are at present being formulated by the Ontario Hydro-Electric Power Commission, and preliminary work in connection with the launching next year of two new developments is being undertaken by engineers of the Commission. From one of these developments, to be located on the Muskosh River, 12,000 h.p., and a possible 20,000 h.p., if required, will be made available. Plans have been drawn up for this plant, and materials necessary for its construction are now being placed. The second development will be carried out on South River, below Huntsville, in proximity to the present South Falls and Hanna Chute plants. The new plant will add 2,300 h.p. to the 6,650 h.p. of the two existing developments.

East Grinstead.—Assisted Wiring Scheme.—The Urban District Council has received sanction to a loan of £500 for wiring installations under the assisted wiring scheme. Under this scheme the charge is to be 8d. per kWh, with a meter charge of 2s. 6d. per quarter and certain discounts according to the quantity consumed.

Continental.—Austria.—A return recently issued by the Water Power and Electricity Economics Office of the Austrian Government shows that at the end of last year there were 218 large hydro-electric undertakings, with a capacity of 321,660 h.p., in operation in Austria. In addition, fifteen new hydro-electric plants, with a total installed capacity of 413,160 h.p., were in course of construction at the commencement of the current year.

France.—The Union d'Electricité de Paris has recently placed a contract with the Société Alsacienne de Constructions Mécaniques, of Belfort, for three turbo-generators for the new power station at Vitry-Sud. The new sets are designed to develop 75,000 kVA at 1,500 r.p.m.

Germany.—Under the auspices of the large State power stations—the Preussag and the Bayernwerke—a new organisation has been formed in Berlin with the title Die Gesellschaft für Deutsche Elektricitäts Wirthschaft. The object of the new concern is to bring about uniform working arrangements between the two undertakings with the object of securing economy in generation and distribution. To this end, the two power stations are to be interconnected by h.p. transmission lines.

Russia.—Work on the construction of a thermo-electric power station with a pressure of 60 atmospheres is proceeding rapidly at the Kleituk works. The power house will be finished by the beginning of October, and in November or December the boilers and turbines ordered in England and Sweden will arrive. This is the first thermo-electric power station with a pressure of 60 atmospheres to be erected in the Soviet Union. The cost of producing electrical energy will be from 2.2 to 2.3 kopecks per kWh (a little over ½d.).—*Reuter's Trade Service* (Moscow).

Dronfield.—Electricity Supply.—The Urban District Council has been granted an Order to distribute electricity in its area. The maximum charge has been fixed at 8d. per kWh instead of at 10d.

Guildford.—Electricity in Bulk.—The Town Council has received sanction to supply electricity in bulk to the Cranleigh Gas & Electricity Co., Ltd. A bulk supply is also to be given to Dennis Bros., Ltd.

Harrogate.—New Plant.—At a meeting of the Corporation on August 14th it was decided to apply for sanction to the borrowing of £38,050 for the provision of a new Parsons three-phase generating set, with accessories, and £11,350 for a h.p. three-phase turbo-alternator and accessories.

Hereford.—Revision of Charges.—The City Council has decided to alter the charges under the "telephone" system as a heavy annual loss has been sustained through the failure of consumers to give notice of extensions, or the installation of new lamps. In private houses the charges are to be based on the ratable value, and the present charge for shops will be doubled. An alternative charge for shops will be considered during the next twelve months.

Llandilo.—Inquiry.—An inquiry was held on August 14th, by Col. T. C. Ekin, for the Electricity Commissioners into the application of the Urban District Council for sanction to install a crude oil engine at its electricity works. The scheme was opposed by the proprietors of Llandilo Sawmills and Mr. D. Pritchard Davies, a ratepayer. Mr. A. Preston, engineer and manager of the Carmarthen Electric Supply Co., Ltd., who represented the Llandilo Sawmills, stated that, as the largest ratepayers, they ought to be allowed to supply the town from their plant, which was idle during the period that the town required lighting and power. Mr. Pritchard Davies contended that a bulk supply from Llanelly would be cheaper. For the Council it was stated that the cost of generating locally was under 6d. per kWh, while Llanelly's charge for a bulk supply was 8¼d., and that of the Sawmills 6¼d. The Commissioners will give their decision in due course.

Plympton.—Electricity Supply.—The protracted negotiations between the Plympton Rural District Council and Messrs. Heath & Co., as to the terms for taking over the latter's electricity works at Plympton, were concluded on August 11th, and an agreement signed. Consumers will be switched over to the public supply on the new mains at reduced prices within a few days, and it is also expected that the supply to Compton will not be further delayed.

Pwllheli.—Street Lighting.—The respective merits of gas and electricity for street lighting have been reviewed by the Town Council. The local gas company had quoted £3 10s. per annum per lamp for 75 lamps, whereas Electricity Distribution of North Wales & District, Ltd., had tendered £1 15s. 8d. per 100-watt lamp for a lighting season of 1,070 hours. The cost of converting street lighting to electricity is £2,392, for which borrowing powers are now being solicited. The Council has decided to ask the company to indicate the difference in cost between laying underground cables in place of overhead lines in certain areas.

Salford.—Year's Working.—We have received from Mr. L. Romero, city electrical engineer, a copy of his report, together with the statement of accounts on the electricity undertaking covering the year ended March 31st last. The total revenue amounted to £318,824, as compared with £291,217 in the preceding year, and working expenses were £157,924, as against £189,259, leaving a gross profit of £160,899 (£101,958), to which was added interest on investments of £5,795, and an unemployment grant of £14,749, making a total of £181,443

available. Capital and other charges absorbed £125,779, and there was a net surplus of £55,663, as compared with £12,149 in 1926-27. A contribution of £15,000 was made to the city rate. The net capital expenditure during the year amounted to £95,699, and included £20,069 for sub-station plant, &c., £30,499 for mains and services, and £33,132 for machinery. The sales of electrical energy increased from 53,333,470 to 60,696,636 kWh, and the maximum load from 23,200 to 24,500 kW. The average price obtained per kWh fell from 1.28d. to 1.23d. Application was made in July, 1927, for sanction to a loan of £150,000 for the provision of a new 20,000-kW set, boiler plant, switchgear, &c., at Agecroft power station, but the decision of the Electricity Commissioners had not been received at the end of the financial year. If and when this extension is completed it will be possible to shut down Frederick Road station completely.

Thirsk. — STREET LIGHTING. — The Parish Council has accepted the tender of the Northern Counties Electricity Supply Co., Ltd., for public lighting with 109 lamps from September 8th to April 13th, at £410.

Uttoxeter.—ELECTRICITY SUPPLY.—The Electricity Commissioners have written to the Rural District Council stating that they have decided to grant an Order to the Urban District Council, and that if, after the scheme is established, it is found to be sufficiently remunerative, they will consider an extension to include other portions of the Rural Council's district.

United States.—ELECTRICAL DEVELOPMENT.—In order to meet future demands for electricity for commercial purposes, the Columbia Gas and Electric system is to install additional generating facilities at its present Ohio stations, West End, Columbia and Miller's Ford, serving Cincinnati, Dayton, and adjacent territory. The additions to each station will, it is thought, obviate the necessity of erecting a complete new generating station. According to the *Electrical World* the four generators now at West End, rated at 31,250 kVA, will be replaced by four new generators, which will each have a rating of 45,000 kVA. The present turbines will be rebuilt to have a capacity of 40,000 kW. These turbines will be able to operate at 700 deg. F. if required. Two of the 31,250-kVA generators now operating at West End will be moved to the Columbia station, where they will be direct-connected to two new high-pressure General Electric turbines rated at 16,000 kW and operated with steam at 600 lb. pressure and 725 deg. F. total temperature. The steam from the new high-pressure units will be exhausted at 185 lb. gauge and 490 deg. F. total temperature, and after having its temperature increased in a reheat boiler to 725 deg. F., it will be used to supply the present low-pressure units, rated at 94,736 kVA. The new rating of the units will be 74,000 kVA each. At the Miller's Ford station there are at present two 12,500-kW units and three 20,000-kW units. A sixth turbine of 25,000-kW capacity is now being installed, and will raise the total station capacity to 110,000 kW. When completed, the new station capacities will be: Columbia, 148,000 kVA; West End, 180,000 kVA; Miller's Ford, 137,500 kVA; a total of 465,500 kVA.

West Midlands.—NEW POWER STATION.—Specifications are being completed by Mr. S. T. Allen, chief engineer and manager for the West Midland Joint Electricity Authority, preliminary to the invitation of tenders for a new power station at Ironbridge. The initial capacity proposed is 160,000 kW. The scheme will include the provision of a large low-temperature carbonisation plant for the extraction of by-products from the fuel before consumption.

Woking.—PURCHASE RIGHTS.—The Urban District Council has been informed by the London and Home Counties Joint Electricity Authority, with regard to the purchase rights of electricity undertakings operating in the area, that in view of the very large measure of agreement upon the principles involved between the local authorities concerned, the Joint Authority has decided to take the necessary steps for the promotion of a Special Order providing for the transfer to the Authority of the purchase rights. This will be upon such terms and conditions as may be approved by the local authority and approved also by the Electricity Commissioners.

Watford.—PRICE REDUCTIONS.—The Town Council has made the following reductions in the charges for electricity: Watford, Abbots Langley and Bushey—Lighting: Flat rate, first 30 kWh in each winter quarter, and first 10 kWh in each summer quarter, 6d. per kWh, and 3½d. per kWh beyond. Outside shop lighting: Flat rate of 3½d. per kWh. Norwich system—All electricity consumed in domestic premises, ½d. per kWh, with a fixed annual charge of 15 per cent. of the net ratable value, with a minimum charge of £5. Power and heating and special heating rate: Rebate off existing tariffs increased from 10 per cent. to 12½ per cent. Parish of Aldenham—Lighting: Flat rate, first 30 kWh in each winter quarter, and first 10 kWh in each summer quarter, 6½d. per kWh, and 3½d. per kWh beyond. Outside shop lighting: Flat rate of 3½d. per kWh. Norwich system: 0.55d. per kWh, with a fixed annual charge of 16¼ per cent. on the net ratable value, with a minimum annual charge of £5 10s. Special heating rate: First 1,000 kWh per quarter, 1½d. per kWh, beyond, 1d., less 12½ per cent. rebate, plus 10 per cent. Power and heating: Varying from 2d. per kWh for the first 2,000 kWh per quarter to 1½d. for over 5,000 kWh, less 12½ per cent. rebate, plus 10 per cent.

Tramway and Railway Notes.

Accrington.—PROPOSED 'BUS SERVICE.—Three towns are concerned in the tramway to Rawtenstall—Accrington, Haslingden and Rawtenstall. Accrington Town Council has received a letter from Haslingden Corporation with respect to the intention of the Corporation to substitute motor omnibuses for its existing tramway, asking if the Town Council would be prepared to support its application. A deputation has been appointed to meet Haslingden representatives on the matter.

Continental.—SPAIN.—The North of Spain Railway Company has recently taken delivery of 37 electric locomotives for service on the line between Barcelona and San Juan de la Abadesas.

Liverpool.—EXTENSION OF TIME.—The Minister of Transport has extended the period for the completion of certain railways under the Corporation Light Railway Order, 1923, to October 31st, 1929.

London. — "UNDERGROUND" TRAFFIC RECORDS. — Record traffic has been carried over the City Railway and the Morden extension this year, the number of passengers carried during the first six months of 1928 being 27,160,109, an increase of 3,064,586, as compared with the corresponding period of 1927. In July, 1922, the last complete month of operation prior to reconstruction, the old City and South London Railway carried 2,327,500 passengers. In January, 1925, the first complete month of traffic after reconstruction, the figure was 2,485,500, while in October, 1926, the first complete month after the inauguration of the Morden extension and the junction at Camden Town with the Hampstead line, 3,716,000 passengers were carried. Thus, the reconstructed and extended line is now dealing with double the traffic that was handled by the old railway.

IMPROVEMENTS AT CAMDEN TOWN.—Since the extension of the Underground Railway to Hendon, Edgware, and Morden, the number of passengers dealt with per annum at Camden Town station has increased from 4,500,000 to nearly 6,000,000. As the traffic is outgrowing the lift and booking-hall facilities, it has been decided to install escalators and provide an automatic booking office similar to the installations which are now in operation at the Bank and Trafalgar Square.

BREAKDOWN.—City-bound passengers from South London were held up on August 16th by a breakdown on the Edgware and Morden Tube. The breakdown was caused by a partial failure of the electricity supply at South Wimbledon sub-station, which lasted about 15 minutes.

Sheffield.—TRAMWAY EXTENSIONS.—Reporting upon the tramway proposals of the Corporation scheduled in the new Corporation Act, the town clerk explains that the following schemes have been approved: An extension of the Handsworth tramway to the city boundary at Woodhouse Mill; an extension from Barnsley Road along Norwood Road and Herries Road to Moonshine Lane; an extension of the Firth Park tramway along Stubbin Lane, Barnsley Road to Sheffield Lane Top; an extension of the intake tramway along Mansfield Road to the corner of Hollinsend Road; a new tramway siding in Pinstone Street; and a junction tramway between Firth Park Road and Page Hall Road.

Swansea.—MUMBLES RAILWAY ELECTRIFICATION.—References were made at the recent annual meeting of the Swansea and Mumbles Railway and Mumbles Railway and Pier Co. to the coming electrical operation of the line which extends from Swansea to Oystermouth, a distance of 5½ miles. The electrification is being carried out on the overhead system, and the work is expected to be completed shortly. Alternating current at 6,600 V is conveyed from the Swansea Corporation's generating station to a sub-station situate mid-way on the railway, where it is converted into d.c. and supplied at a line voltage of 600. The Metropolitan-Vickers Electrical Co., Ltd., has equipped the sub-station, which comprises two 500-kW rotary convertors, with provision for a third set if necessary. The rolling stock has been supplied by the Brush Electrical Engineering Co., Ltd. The cars are of the double-deck, top-covered type, each having seating accommodation for 106 passengers. The Mayor of Swansea will inaugurate the new system.

Thornaby-on-Tees.—EXTENSION OF TIME.—The Minister of Transport has authorised the extension of the period for the completion of the tramways under the Corporation Tramways Order, 1919, until August 15th, 1929.

Warrington.—EXTENSION SCHEME DEFERRED.—The Corporation Tramways Committee has decided to defer consideration of the extension of the tramway track from the Cemetery terminus to Bruche Bridge pending the result of a trial 'bus service on the route.

TRAMWAY SUPPLY.—The Electricity Committee has appointed a sub-committee to deal with a proposal of the Tramways Committee to purchase from the department all electrical energy necessary for the tramway undertaking.

Telegraph and Telephone Notes.

Belgium.—Brussels.—A new automatic telephone exchange, making the eighth in the Brussels area, is to be erected in the suburb of St. Gilles.

Central Asia.—Automatic Telephony.—An automatic telephone exchange is to be built at Tashkent, in Soviet Central Asia. The exchange will cost more than £200,000, and will be for 10,000 lines. Practically all the telephone exchanges that are now being built in the Soviet Union are automatic.

France.—Conversation Recording Instruments.—The French Post and Telegraph Authorities have recently authorised the use of conversation recording instruments in connection with telephone receivers. The recorders are being so fitted that they do not prevent the use of the telephone in the usual way; they are so arranged, however, that any important message can be taken down on a permanent phonograph record.

Guernsey.—Telephone Service to Mainland.—The *Birmingham Post* reports that, following on the agitation for a telephone service to the Isle of Man, the Guernsey Growers' Association has addressed a letter to the Postmaster-General drawing attention to the fact that the Channel Islands are still without a telephone line to the mainland. Guernsey runs its own interior telephone service, and has the largest number of telephones in proportion to population outside the United States.

Portugal.—Telephone Service.—Proposals for the installation of a telephone system throughout Portugal have been made to the Portuguese Government by the International Telegraph and Telephone Company, says the *Financial Times*. The organisation, it is suggested, would be under Portuguese management.

Singapore. — Automatic Telephony. — The Oriental Telephone and Electric Co. has decided to replace the present plant in Singapore with an automatic exchange on January 1st, 1930. The existing central exchange has a capacity of 5,000 lines, which will be in full use by the end of 1929, when the new system will provide accommodation for 6,600 lines, with an ultimate capacity of 10,000.

Radio Notes.

Australia.—Victoria.—The *Electrical Engineer of Australia and New Zealand* reports that for the first time since wireless broadcasting became a national entertainment in Australia there has been a decrease in the number of listeners' licences in Victoria. Returns for the month of May show that the number of licences which were not renewed in that State was over 200 in excess of the new licences issued during the month. In all the States except Victoria and West Australia the excess of new licences over cancellations was maintained last month. The total number of licences in force in Victoria is now 136,496, and the number throughout the Commonwealth is 267,178.

New South Wales.—The New South Wales Broadcasting Co., Ltd., has been formed in Sydney, with authorised capital of £100,000, for the purpose of taking over and operating the A class broadcasting stations now controlled by Farmer's (2FC), Ltd., and Broadcasters (Sydney), Ltd. (station 2BL). Some of the directors are associated with the Dominion Broadcasting Co. Pty., Ltd., which recently took over the A class stations in Melbourne. The Sydney stations, like those in Melbourne, will retain their individuality, but the programmes will be so arranged as to avoid duplication.

Transatlantic Relays.—B.B.C. Tests.—Experiments will shortly be made by the British Broadcasting Corporation, in association with the National Broadcasting Company of America, with the object of relaying American programmes to British listeners by a new method, says *The Times*. Fading has been one of the chief obstacles to successful broadcasting across the Atlantic, but it is now hoped that a remedy for it will be found. The experiments in reception will be carried out at the receiving post of the B.B.C. at Keston, and the transmissions will be made from the short-wave stations of the General Electric Company, Schenectady.

The B.B.C. receiving station at Keston will use, according to the *Wireless World*, five separate receivers on wavelengths varying between 16 and 50 metres, to pick up five individual transmissions of the same programme from the satellite stations of WGY at Schenectady. For relay purposes the five receivers will have a common output. This method of avoiding fading and atmospherics has been advocated by Dr. Alfred N. Goldsmith, of the U.S. National Broadcasting Company, as well as by Capt. P. P. Eckersley.

Russia.—Patents.—The Soviet Government is reported to have concluded preliminary arrangements with the Radio Corporation of America for the exchange of patents.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Argentina.—Buenos Aires.—October 5th. Department of Navigation and Ports. One 20-ton electric transporter. (A.X. 6694.)*

Australia.—Melbourne.—October 2nd. Posts and Telegraph Department. Switchboard cords. (B.X. 4621.)*

August 29th. Victorian Railways. Private automatic telephone exchange and accessories. (B.X. 4652.)*

November 6th. Automatic telephone switching equipment. (B.X. 4638.)*

October 16th. Telephone register coils and mounting plates. (B.X. 4639.)*

October 22nd. State Electricity Commission of Victoria. Transformer and spares for the Yallourn power station and the Richmond terminal station. (B.X. 4637.)*

Belgium.—Antwerp.—September 6th. Port Authority. 35 steel masts for electric lighting. (A.X. 6704.)*

September 27th. Supply and erection of 32 electrically-operated portal travelling cranes. (A.X. 6712.)*

Bradford.—Electric lighting installation, eight combined shops and houses, Swain House estate, and eight combined shops and houses, Lower Grange estate. Tenders to Mr. N. L. Fleming, town clerk, Town Hall.

Brentwood.—September 8th. Essex and Colchester Mental Hospital Committee. Electric cables, conduits and control gear for the Brentwood Mental Hospital. (August 17th.)

Bridport (Dorset).—September 29th. Town Council. Power-house equipment, Section 2, including three generating units totalling about 600 kW. (See this issue.)

Bristol.—August 30th. Board of Guardians. Electrical fittings for six months. Mr. T. S. Lamb, clerk, St. Peter's Hospital.

Edinburgh.—September 7th. Corporation. Structural steel work for coal bunkers in the electric generating station extension, West Bank, Portobello. Schedule from city architect.

Egypt.—Cairo.—October 20th. Ministry of the Interior. D.c. generator set for the Beni Mazar power station. (B.X. 4660.)*

Exeter.—September 1st. Standing Committee for Devon. Supply of electric lamps for three years for use of the police. Forms of tender from the Chief Constable of Devon, The Castle, Exeter.

India.—September 6th. Assam-Bengal Railway Co., Ltd. Overhead electric cranes. Specification 21s., from the offices of the company, Bishopsgate House, E.C.

Llandudno.—September 4th. Electricity Department. E.h.p. and l.p. cables, cubicles, transformers and unit-type feeder pillars. (August 10th.)

Llantarnam.—September 3rd. Urban District Council. H.p. and l.p. switchgear, transformers, and overhead and underground mains. (July 27th.)

London.—St. Pancras.—September 4th. Electricity Department. One 15,000-kW generator, condenser, and auxiliaries for the King's Road generating station. (August 3rd.)

Hackney.—August 29th. Board of Guardians. Installation of telephone and fire-alarm system at the Branch Institution and School, Brentwood. (August 10th.)

Stoke Newington.—Electricity Department. Twelve months' supply of paper-insulated, lead-sheathed and armoured cables; 12 months' supply of d.c. house service meters. (August 17th.)

H.M. Office of Works.—September 4th. Supply of electrical and mechanical engineering labour in daywork in Cardiff. (August 17th.)

Manchester.—August 31st. Electricity Committee. Eight 250-kVA, eight 500-kVA, and two 125-kVA static transformers. (August 10th.)

Hospital Sub-Committee. Electric lighting installation for the Baguley Sanatorium. (August 10th). Supply and erection of three twin v.i.r. taped lead-covered, steel tape, armoured, and jute served, 600 megohms grade cables. (See this issue.)

New Zealand.—Wellington.—September 11th. Public Works Department. Two 10-cwt. electric travelling indoor cranes. (A.X. 6545.)*

October 30th. Protective relay system. (B.X. 4573.)*

September 4th. Insulating tape. (B.X. 4572.)*

September 25th. Meter-testing equipment for Lake Coleridge. (B.X. 4570.)*

Dunedin.—September 28th. Otago Harbour Board. Two 3-ton electric wharf cranes. (A.X. 6621.)*

Oldham.—September 10th. Board of Guardians. Electric lamps and fittings for the Institution, Rochdale Road. Form of tender, &c., from Mr. F. W. Fletcher, clerk to Guardians, Union Offices.

Paulton.—September 17th. Board of Guardians. Electric lighting installation at the Isolation Hospital; Mr. A. J. Pictor, architect, 14, Queen Square, Bath.

Pentre, Rhondda.—September 4th. Rhondda Urban District Council. Electricity Department. One 150-kVA 3,500/414-V, 3-phase static transformer and one 150-kVA, 11,000/414-V ditto. (August 17th.)

Rochdale.—August 31st. Electricity Department. 500 electric wash boilers during 12 months. (August 10th.)

Salford.—August 31st. Board of Guardians. Electric lighting and power installation for the new garage and East End Rooms of the Eccles New Road Institution. (August 17th.)

South Africa.—Johannesburg.—September 11th. Rand Water Board. Turbo-generator for the Vaal River scheme. (B.X. 4585.)*

August 30th. Town Council. Street-lighting time switches. (B.X. 4584.)* 1,000-kVA and 250-kVA transformers. (B.X. 4618.)* Six 10-kVA induction voltage regulators. (B.X. 4617.)*

October 26th. Electricity Supply Commission of South Africa. Plant and equipment for a hydro-electric power station and outdoor sub-stations. (B.X. 4622.)*

Railways and Harbours Board.—September 20th. One electrically-driven heavy-duty double-face-plates wheel lathe for Germiston repair shops. (A.X. 6660.)*

September 27th. Arc welding sets. (B.X. 4647.)*

Volksrust.—September 11th. Municipal Council. Switchgear, motors, meters, cables, &c. (B.X. 4599.)*

Cape Town.—September 4th. Electricity Department. One 1,000-kW convertor set. (B.X. 4604.)*

August 31st. 29,300 yd. multi-core paper-insulated lead-covered cables. (B.X. 4633.)*

September 1st. Electric cables. (B.X. 4649.)*

September 14th. Electricity meters. (B.X. 4648.)*

Pretoria.—October 4th. Department of Posts and Telegraphs, Copper wire and lead covered cable. (B.X. 4657.)*

South-East England.—October 5th. Central Electricity Board. Supply, delivery, and erection of 132,000-V outdoor switchgear for the transforming stations in the area covered by the South-East England Electricity Scheme, 1927. (See this issue.)

Stoke-on-Trent.—September 12th. Electricity Department. Two water-tube boilers (60,000 lb. per hour). (August 3rd.)

Electricity Department. One 1,200-amp. secondary storage battery. (August 17th.)

Uruguay.—Montevideo.—September 10th. State Electricity Department. 338,000 metres of insulated conductors for outdoor use (Hackethal type). (B.X. 4589.)*

September 3rd. 155,000 metres of r.i. wire for indoor installations. (B.X. 4590.)*

September 17th. 4,500 metres lead-covered cable, with junction and terminal boxes. (B.X. 4608.)*

September 19th. Lead-covered conductors. (B.X. 4607.)*

September 28th. R.I. wires and cables for indoor installations. (B.X. 4651.)*

October 5th. Electrical material. (B.X. 4666.)*

Walsall and West Bromwich.—September 28th. Unions Joint Committee. Supplies, including electrical fittings. Form of tender, &c., from Mr. A. H. Ward, clerk, 22, Lombard Street, West Bromwich.

Waterford.—September 14th. Corporation. Single-phase and three-phase alternating-current house service and other meters. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Ampthill.—Rural District Council. Accepted:—
Wiring houses at Maulden for electric light (£4 15s. per house).—B. Swaffield.

Australia. — Sydney. — The Civic Commissioners have accepted the tender of the General Electric Co., Ltd., of London, for 102,500 yd. 33,000-V cable and 101,000 yd. pilot cable, at £149,331.—*Reuter* (Sydney).

Melbourne.—State Electricity Commission. Accepted:—
Two 10,000-kW turbo-generators for Yallourn (£51,600).—Siemens (Aust.) Pty., Ltd. (English Electric Co., Ltd.).

Deal.—Accepted:—
Rewiring and fittings for the Winter Garden Theatre.—C. O. Clark (Deal).

Dundee.—Public Health Committee. Accepted:—
Electric lighting installation at Ashludie Sanatorium.—Stenson & Co.

Egypt.—Cairo.—The Automatic Telephone Manufacturing Co., Ltd., has submitted the lowest tender, *viz.*, £E12,632, for the erection of an automatic telephone exchange at Mansura.—*Reuter's Trade Service* (Cairo).

Government Contracts.—The following contracts were placed by Government Departments during July:—

Admiralty (Contract and Purchase Department).

Modifications to turbo-alternators.—British Thomson-Houston Co., Ltd.
Charging boards.—Park Royal Engineering Co., Ltd.
Electric hot cupboards.—General Electric Co., Ltd.; Credenda Conduits Co., Ltd.
Electrodes.—Alloy Welding Processes, Ltd.
Ship-ventilating fans.—General Electric Co., Ltd.
Table fans and spares.—General Electric Co., Ltd.; Veritys, Ltd.
Motor generators.—Newton Bros. (Derby), Ltd.; Mackie and Co., Ltd.
Installation of cable and electric light.—G. E. Taylor and Co.
Electric welding plant.—Marryat & Place.
Valves (w./t.).—Mullard Radio Valve Co., Ltd.

War Office.

Batteries and cells.—General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Battery and stands.—D.P. Battery Co., Ltd.
Petrol-electric crane.—Ransomes & Rapier, Ltd.
Generating sets.—Douglas Motors, Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.; Stella Lamp Co., Ltd.; General Electric Co., Ltd.; Cryselco, Ltd.
Searchlight lamps.—Park Royal Engineering Co., Ltd.
Rotary convertor.—Electric Construction Co., Ltd.
Ventilating plant.—J. Keith & Blackman Co., Ltd.

Air Ministry.

Cells —Le Carbone.
Generators.—British Thomson-Houston Co., Ltd.
Identification downward lamps.—Smith & Ansell, Ltd.
Navigation lamp fittings.—Siemens Bros. & Co., Ltd.
Reaction testing apparatus.—Cambridge Instrument Co.
Receivers (R.40).—H. W. Sullivan, Ltd.
Transmitters.—Gambrell Bros., Ltd.

Post Office.

Telephonic apparatus.—Ericsson Telephones, Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Telephone Manufacturing Co., Ltd.
Testing, protective and miscellaneous apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Elliott Bros. (London), Ltd.; Everett, Edgcumbe & Co., Ltd.; General Electric Co., Ltd.; Highton & Son, Ltd.; W. Jones & Co.; Phœnix Telephone & Electric Works, Ltd.; Power Equipment Co., Ltd.; Siemens Bros. and Co., Ltd.; Standard Telephones & Cables, Ltd.; Stuart Turner, Ltd.; Witton Kramer Electric Tool and Hoist Works (General Electric Co., Ltd.).
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.
Battery stores.—Siemens Bros. & Co., Ltd.
Cable.—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover and Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Cords for telephones.—Reliance Electrical Wire Co.; British Insulated Cables, Ltd.
Insulator rings.—Avon India Rubber Co., Ltd.
Copper enamelled wire.—Connolly's (Blackley), Ltd.
Replacing batteries.—Portsmouth automatic telephone exchange: Alton Battery Co., Ltd.

Telephone exchange equipment.—Portslade, Brighton Central, Hove, Southwick, Preston, Rottingdean: Siemens Bros. & Co., Ltd. Stanmore: Standard Telephones and Cables, Ltd. (Sub-contractors: Crompton-Parkinson, Ltd., for charging machines; Hart Accumulator Co., Ltd., for batteries.) Hendon: Automatic Telephone Manufacturing Co., Ltd. (Sub-contractors: Newton Bros. (Derby), Ltd., for machines; Alton Battery Co., Ltd., for batteries.) Ryde (I. of W.): General Electric Co., Ltd. Connah's Quay (Flints.): Ericsson Telephones, Ltd.

Crown Agents for the Colonies.

Air compressors.—Westinghouse Brake and Saxby Signal Co., Ltd.
Blade system for turbo-alternator.—Brush Electrical Engineering Co., Ltd.
Cables.—Callender's Cable & Construction Co., Ltd.; W. T. Glover & Co., Ltd.
Ceiling fans.—Veritys, Ltd.
Distribution kiosks.—English Electric Co., Ltd.
Electric lighting fixtures.—Burt, Escarś & Perry & Co.
Generating set.—Belliss & Morcom, Ltd.
Insulators.—Doulton & Co., Ltd.
Lifts.—Waygood-Otis, Ltd.
Switchgear.—Ferguson, Pailin, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.; Radio Communication Co., Ltd.

H.M. Office of Works.

Primrose Hill telephone exchange, Birmingham. Cables, &c.—T. Clarke & Co., Ltd. Hot plates.—Electric Fires, Ltd.

Kendal.—Board of Guardians. Recommended :—
Generating and distribution plant (£825).—Gilbert Gilkes and Co., Ltd.

Leeds.—Accepted :—
Lighting, power, and telephone installation for the new Maternity Hospital.—Cloke's Extension, Ltd.

Shanklin.—U.D.C. Accepted :—
Metal filament lamps.—Economic Guaranteed Electric Lamp Co.

Shipley.—Yorkshire Electric Power Co. Accepted:—
Electrical transmission line from Shipley to Silden.—Callender's Cable & Construction Co., Ltd.

Stourbridge.—Board of Guardians. Accepted ::—
Installing electric light at Wordsley Institution and Sandfield House (£937).—Mr. R. Priest.

Warrington.—Electricity Committee. Accepted :—
Two feeder panels for the extension of the main e.h.p. switchboard at the power station.—British Thomson-Houston Co., Ltd.

Forthcoming Events.

Institute of Metals.—September 4th to 7th. Liverpool. Autumn meeting.

British Association.—September 5th to 12th. Glasgow. Annual meeting.

Machine Tool and Engineering Exhibition.—Olympia, W. September 5th-22nd.

Municipal Tramways Association of Great Britain and Ireland.—September 12th-14th. Manchester. Annual conference.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

Rex 3-pin combined plug and switch.

Carlite motor-car bulbs.

A " clock " indicator for fixing to electric radiators showing the number of hours they are in use.

Wirn insulating paper.

Vacuum cleaners suitable for billiard tables (lists wanted).

Notes.

Arc-welding in the United States.

The Westinghouse Electric and Manufacturing Company is building a large arc-welding laboratory at East Pittsburgh, Pa., U.S.A. Already the company has erected by the arc welding process two buildings in its Sharon works; one building in its Derry works; seven buildings in its East Pittsburgh headquarters; a bridge 55 feet long at Turtle Creek, and a bridge 175 feet long at Chicopee Falls. Altogether these structures involved the arc-welding of nearly 1,600 tons of steel. At present the company is planning three more buildings at Trafford, all of which will be welded.

The new laboratory will be 75 feet wide, 170 feet long, and 40 feet high. The structure houses a 50-ton crane, and in addition to the installation of arc-welding equipment, it will have heavy rolling and forming equipment to be used for shaping the various parts that go into welded machinery, including motor and generator frames, motor rotor rims, and end bells.

Amongst the products the company expects to weld in the future arc generator frames, locomotive frames, synchronous motor frames and spiders, boxes, machinery bases, floor plates and tanks, miscellaneous machinery parts, industrial heating apparatus, steel pipes, and shop furniture. At present a 26-ton turbine generator frame, entirely welded, is being fabricated on the shop floors.

Farm Electrification.

According to the *Wheeling, W. Va., Register*, farm electrification is a proved success. Statistics on the Red Wing, Minnesota, experimental rural line show that future prosperity and emancipation from hard work for the farmer are going to come through the use of electricity. Continuous records are available for the five farms served during the experiment over a period of four years. At the end of that time it was found that revenue had increased 42.9 per cent. over 1924, when electricity first was employed, and that investment had increased but 8.8 per cent. Operating expense actually declined 3.6 per cent. Dairy products in 1927 gave 86.7 per cent. more revenue than in 1924, and poultry products 88 per cent. more. And the total electricity bill for five farms in 1927 was $886.54. This is but the bare skeleton of the many results of the experiment. It has demonstrated conclusively that electricity will pay its own way on the farm, when properly used, and do a great deal more besides. As a comfort in the farm home, raising the level of living, and as a labour, time, and money saver in the business end, it is fast becoming the accepted thing. It is safe to say that in the not distant future farm electrification will be necessary and indispensable.

Electrical Refrigeration.

At the Royal Sanitary Congress, held at Plymouth last month, a paper on " Electrical Refrigeration " was read by Lt.-Col. W. A. Vignoles, D.S.O., director of the British Electrical Development Association. He said that it might be thought that the average temperature in England was not sufficiently high to cause trouble, but actually on very many days of the year the temperature and humidity were such as to encourage the activities of the bacteria which caused the deterioration of food. These micro-organisms multiplied very rapidly at a temperature of 50 deg. F., but became practically inert at temperatures below 45 deg. F.

Bacteria could be destroyed by pasteurisation, that is by raising the temperature of liquids or food above a certain level, but this only delayed the matter, while the characteristic taste and properties of the food might be changed thereby. The logical outcome of abolishing preservatives was the use of a refrigerator in which food might be kept at a temperature at which the bacteria germs could not develop.

The cold-producing part of the refrigerator was, in working, kept below 30 deg. F., so that the moisture in the air of the cold chamber froze upon it and the air was in this way kept dry. An electrical refrigerator might be operated either by a small motor-driven pump or by means of a heating coil. Some refrigerators required a supply of cold water, but with others air cooling only was necessary; in any case they could be depended upon to work with little attention beyond oiling a few times a year, adjusting a switch from time to time, or ensuring that the water supply, if such was necessary, was maintained.

Refrigeration was a necessity now to large numbers of tradesmen if foodstuffs were to be kept in sound condition up to the moment they were sold to the public. A housewife provided with a refrigerator would be in a position to ensure that food brought to the table was in a satisfactory condition, to buy food to better advantage, and to provide more palatable dishes throughout the year.

The amount of electricity used for a small cabinet for household purposes might be 3 or 4 kWh per day, according to the size of the plant and the temperature of the air, less electricity being required in cold weather.

In new houses and in trade premises it appeared to the author that a part of the building would in future often be heat-insulated and fitted up as a refrigerator; already in London certain blocks of flats were provided with a refrigerator space in each flat with a common refrigerating machine in the basement, " central cooling " in fact being provided in the same way as central heating. The architect should at least

consider where the refrigerator was to go and make provision for it. After all, in small houses, where the least space was available, the need for refrigeration was greatest.

Electrical refrigerators could be made entirely automatic, the supply of electricity and water being controlled by suitable thermostats.

The Professional Classes Aid Council.

The annual report of the Council for the year ended April 30th, 1928, shows that the number of applications for relief increased to 780, as compared with 758 in 1927. Financial help was given to 154 families, and 334 inquirers were advised where to apply for help, as well as many of the remainder whose needs did not bring them within the scope of the Council's work. Many professional people apply to the Council in ignorance of the existence of benevolent funds in their own professions. Each case is decided on its merits: the applicant must be of the class eligible for assistance, there must be real need, and the cause of distress must not be such as could have been naturally foreseen and provided against. These conditions satisfied, the Council interposes no red tape between the applicant and its resources. A generous donor has enabled the Council to spend £500 a year in the shape of permanent allowances to old people and incurable invalids. The amount spent on education was £2,569, a sum larger than in any previous year, and 58 children were helped. Training has been assisted in 28 cases, and £863 has been distributed in the form of gifts to meet special requirements.

The total income was £8,859, and the expenditure £8,072, leaving a balance of £787. The address of the hon. treasurer (Hon. George Colville) is 251, Brompton Road, S.W.3. Since the close of the period covered by the report, the Queen has consented to become the Patroness of the Council.

The Thermal Rating of Transformers.

The basis of the true thermal rating of a transformer is the maximum temperature which the insulation will withstand without damage. In the design of a transformer to meet any specified loading conditions, calculation of the true thermal rating is necessary in order to make the most economic and efficient use of the material. Since the capacity of a transformer depends on external loading conditions, such as duration of load and temperature of cooling medium, predetermination of the thermal rating is also necessary for any combination of loading conditions that may occur in practice. Measurement of the true thermal rating while the transformer is in service is required partly as a check on the calculated rating, partly as a protection against overloading, and partly so that full and efficient use may be made of the available capacity of the transformer. In a paper published in the current issue of the I.E.E. *Journal*, Mr. E. T. Norris, M.I.E.E., deals with these problems: In the first part a practical method of calculating the true thermal rating of a transformer under any given conditions of loading is developed; in the second part of the paper the measurement of the thermal rating is considered. An instrument is described which indicates, while the transformer is in service, the proportion of the maximum safe rating actually being utilised, and gives warning whenever the safe temperature limit is reached.

International Conference on Bituminous Coal.

The Second International Conference on bituminous coal, to be held under the auspices of the Carnegie Institute of Technology, Pittsburgh, U.S.A., on November 19th-24th, 1928, will be similar in purpose to the first Congress, held in 1926, but the preliminary plans for this year's meeting show that its scope will be considerably enlarged, and the programme will be more important and more international in character. Fixed nitrogen, the liquefaction of coal, and low-temperature distillation will be discussed, and the production of power from coal, coal tars and oils, the complete gasification of coal, and pulverised-coal are other topics that will be considered. Among the British authorities who are expected to attend the Congress are Lord Melchett, Dr. E. W. Smith, Dr. C. H. Lander, Mr. Harald Nielsen, Colonel Lindemann, Dr. R. Lessing, Mr. Edgar C. Evans, and Mr. F. S. Sinnatt.

State Employés' Inventions.

Inventors in the employ of the U.S. Federal Government are to retain the title rights to their patents by virtue of recent patent legislation by Congress. In future the State-employed inventor will merely grant a licence for the use of the apparatus by the Government.

The *Wireless World* believes this decision to be the outcome of the controversy between Maj.-Gen. G. O. Squier, former chief signal officer of the U.S. Army, and the American Telephone and Telegraph Co., regarding wired-wireless, the latter contending that free use could be made of Gen. Squier's invention, as the General was a public servant!

Train Collision Report.

The report of the official Inquiry into the circumstances of the accident which occurred at Euston on the London, Midland & Scottish Railway on April 30th, when an incoming train was inadvertently turned into the wrong platform and collided with some standing coaches, has just been issued. It is evident that the accident was brought about by the omission to reverse the points prior to the clearing of a disk signal. The signalling and locking concerned have been in satisfactory use for many years, but it is clear, the report says, that the arrangements have the defect that a mistake of this kind is not safeguarded; track circuiting or its equivalent would have prevented the accident. It is understood that consideration is being given to the question of the signalling controlling movements of empty trains into the departure side of the station.

Electrical Accidents in Switzerland.

The Swiss Electricity Inspection Department has recently issued its report on the accidents which occurred in connection with electricity supply—excluding electric tramways and railways—in Switzerland during 1926. It shows that 21 persons were injured and five killed in connection with installations at pressures up to 250 V, as against 16 and 5, respectively, in 1925. In connection with installations at over 250 V, 32 were injured and 19 killed, as compared with 32 and 13, respectively, for the preceding year.

Fatalities.

Five persons were killed near Grenoble on August 15th through coming into contact with electric cables which had been blown down during a thunderstorm.

An inquest was held on August 16th on Charles Wilkinson, who received a fatal electric shock at the Brimsdown power station of the North Metropolitan Electric Power Co., on August 9th. It was stated that Wilkinson was found lying at the foot of a generator next to one on which he had been working. He received a shock of 33,000 V. A verdict of "Accidental death" was returned.

New Mines Research Station.

The Mines Department announces that the Prime Minister has agreed to perform the formal opening ceremony on October 11th of the new laboratories which have been built at Sheffield for the Safety in Mines Research Board. This new research station will be the country's chief centre for scientific experiment for making coal mining a safer occupation. Commodore H. Douglas King, Secretary for Mines, will preside at the ceremony.

New Electrical Inventions in the Soviet Union.

At the All-Union Electrotechnical Conference recently held in Moscow, a number of new inventions were demonstrated which promise to be of considerable importance for the industry. Mr. Talalaev has invented an electrical harvester, by means of which the grain stalks are burned through with a bare wire heated by a generator; the latter is located in one of the cars which serve to support the wire and to furnish tractive power for the harvester. A model was exhibited of a mercury rectifier for converting three-phase current into single-phase; this equipment, which was first manufactured in the Soviet Union, is said to be working quite satisfactorily. Professor Vologdin exhibited a new mercury rectifier invented by him. This apparatus is designed to replace oil circuit breakers in large generating stations. Besides being less cumbersome than the old apparatus, it removes the danger, it is claimed, of explosions from "short circuits."

Academician Joffe demonstrated his new thinly laminated insulation, the invention of which resulted from his discovery of the principle of the high insulating power of very thin insulation. Whereas formerly heavy porcelain, glass, or composition insulators were required for high voltages, Professor Joffe's apparatus, with a thickness of insulation varying from 0.1 to 0.01 mm., is said to withstand pressures exceeding 100,000 volts without danger to the insulation.

Marine Leader Cable in Spain.

It is claimed at Corunna that the trials of the "pilot cable" devised by a French engineer, M. Loth, were attended with great success when demonstrated before General Primo de Rivera, the Premier, and members of the Cabinet. The gunboat *Dato*, guided by the cable, performed evolutions with remarkable precision in the canal, listening for warnings from the cable every few minutes while in the "danger zone." Pilot cables will be installed in all other important Spanish ports.—*Reuter* (Corunna).

A Thermionic Voltmeter.

A thermionic voltmeter which can be used to measure the peak and mean values of any alternating wave-form is described by Mr. E. B. Moullin, M.A., A.M.I.E.E., in a paper published in the current issue of the I.E.E. *Journal*. The instrument is provided with two scales on one dial, corresponding to peak and mean values, and a change-over switch converts the voltmeter from one reading to the other. The peak value is measured by the mean grid current of a cumulative grid rectifier. The mean grid potential is sensibly equal to the peak value of a sinusoidal voltage and an approximate analysis is developed by which the mean grid current can be predicted very accurately. The mean grid current is sensibly proportional to the peak value of any wave-form, and results are tabulated of direct tests on five different wave-forms, the oscillograms of which are reproduced; at least three of these wave-forms are extraordinarily irregular. The accuracy of the peak measurement is about the same as can be obtained from an ordinary oscillogram. The mean-value measurement is made by omitting the grid condenser, and the accuracy of the method is discussed analytically and substantiated experimentally. An application of the voltmeter is illustrated by curves which show the distortion produced by a 4-stage thermionic amplifier.

Fire Protection in Factories.

The Home Office has recently issued Safety Pamphlet No. 13, dealing with "Fire Protection in Factories" (H.M. Stationery Office, price 6d. net, by post 8d.). The book is arranged in three parts, the first of which is devoted to a general description of the fire appliances most useful for the protection of factory premises, with fuller notes on the characteristics and special uses of some of the more efficient types. The carbon tetrachloride fire extinguisher is described as being the best available for "electrical fires," and particularly suitable for use on h.p. machines, as the liquid is a non-conductor, very volatile, and has no rusting properties. Part two deals with the necessity for proper organisation for fire-extinguishing work, and part three with the need for keeping records of the tests made on and inspections carried out on the appliances.

Cast-Iron Research Association.

Bulletin No. 21, July, 1928, of the British Cast-Iron Research Association contains the interesting announcement that a crucible furnace for experimental work by the Association has been installed at the works of Messrs. Lee, Howl and Co., Ltd., Tipton, by courtesy of the directors. The furnace was provided free of all charge to the Association by the Morgan Crucible Co., Ltd., and the necessary fan and driving motor were similarly provided by Messrs. Jas. Keith, Blackman Co., Ltd. It has for some time been felt that it would be essential for the Association to have provision for melting independent of the works facilities which have been provided in the past, and the above free gifts and accommodation are the result of the Association's efforts to obtain such independent facilities. The programme in the works of members will not in any way be modified or diminished.

The annual meeting of the Association will take place in London on October 31st next.

The Sydney Bribery Cases.

The Times Sydney correspondent reports that at the sitting on August 16th of the Royal Commission inquiring into the coal contracts, Mr. H. M. Moore, a coal agent, said that Alderman Holdsworth in 1921 told the witness that he could influence the coal contract if the witness paid £500 cash and a commission of 2s. a ton. Mr. R. Woof, the power-house superintendent, said he had received regular payments from Mr. James Johnston, manager of B. Byrnes, Ltd., who had contracts with the Sydney Council. "Once Mr. Johnston gave the witness £300 for himself, and a larger sum for Mr. Silas Maling. The witness handed the money to Mr. Maling in notes."

The Times also reports that at a later sitting of the Commission, Mr. Richard O'Halloran, secretary of the Austral Investment Co., Ltd., gave evidence that contractors were prepared to pay to the wives of Alderman Mostyn and Alderman English 2d. per ton each on 224,000 tons of coal for the City Council.

Local Societies.

The programme for the 1928-29 session of the Rugby Engineering Society, which commences on October 18th, provides for the following lectures:—"Electricity in the Home," by Lt.-Col. W. A. Vignoles, D.S.O., M.I.E.E.; "Modern Welding Practice," by F. L. Ballard, A.M.I.E.E.; "Wireless Valves," by L. J. Davies, B.A.; "Aluminium, its Production and Application," by E. T. Painton, British Aluminium Co., Ltd., B.Sc., A.M.I.E.E.; "Application of Electricity in Curing Disease," by C. H. Holbeach and Dr. Simey; "Modern Diesel Engines," by C. H. Paulin, A.M.I.Mech.E.; "Recent Developments in A.C. Machines," by H. Jack, B.Sc., M.I.E.E.

Appointments Vacant.

Assistant divisional engineer, telegraphs, for the Indian Posts and Telegraphs Department. Hired apparatus superintendent for Worksop Urban District Council. (See our advertisement pages to-day.)

Sweden's Electric Power Problem.

The transmission of electric power to the industries of Central and South Sweden from the enormous water-power resources of the North is now one of the most important industrial problems of Sweden, according to Captain Mauritz Serrander, managing director of the big Hammarsforsens Power Company, the most recent of Sweden's great hydro-electric plants. Mr. Serrander, in a lecture to the Sundsvall Chamber of Commerce, stated that of Sweden's nine million available turbine horse-power, seven millions was located in Norrland. Of this, only 6 per cent. had, so far, been exploited, which showed that the country still had immense reserves at its disposal. The water power of Central and South Sweden is already to a great extent utilised, and the demand for power for industry is growing continuously, so that, unless new steps are taken for the purpose of transmitting power from the North a serious shortage may in time arise. In the first place, the great waterfalls of the River Indalsaelven must be harnessed. A number of the leading power consumers of Sweden, such as the city of Stockholm and the factories in Central Sweden, have already contracted for the supply of electrical energy from these falls.

Institution Notes.

Institution of Electrical Engineers.

Students' Section.—The summer meeting of the Students of the Institution this year was held in Holland and Western Germany. The party, numbering 31, including members from the provincial Centres, on Sunday, July 29th, reached Rotterdam, and in the afternoon paid a visit to the Hague and Scheveningen. On Monday morning a visit was made to Messrs. Willem Smit of Slikkerveer, the well-known electrical machinery manufacturers, and in the afternoon the party visited the Nederlandsche Kabelfabriek works at Delft, where the manufacture of paper-insulated cables was seen. The same evening the party left for Utrecht, where, on the Tuesday, the Central Power Station was visited, and the Electrotechnische Mechanische Industrie, makers of electric fans. In the power station, built in 1924, were noticed boilers of a well-known English make.

On Wednesday the party left Utrecht for Eindhoven, in pouring rain; on arrival it was met by Mr. R. J. Castendijk, of Messrs. Philips Lamps, and after luncheon, at the kind invitation of the company, an interesting afternoon was spent in watching the manufacture of lamps. Essen was the next stop, where a visit was made on Thursday to Messrs. Krupps' works, and on Friday the journey to Cologne was broken at Dusseldorf to visit the Matthes Fisher works, manufacturing tin boxes. On Saturday morning a visit was made to the Cologne Broadcasting Station.

On Sunday the majority of the party went by train to Coblence and back down the Rhine by steamer, but unfortunately rain fell all day. At dinner on Sunday evening a small presentation was made to Mr. Hart, hon. secretary, London Section, by the party in appreciation of his work in connection with the tour. On Monday the last visit of the tour was made to Messrs. Felten & Guilleaume's works, where the manufacture of wire and cables was seen. From Cologne the party returned direct to London, which was reached on Tuesday morning, August 7th. In all about 1,100 miles was covered and a very enjoyable and instructive ten days' holiday was spent.

Institution of Heating and Ventilating Engineers.

The next examination for admission as Graduates and Associate Members will be held in September; intending candidates should apply to the Secretary, Mr. H. B. Watt, 12, Russell Square, W.C.1. Association-Member and Graduate sections are in existence in London and Manchester, and are being formed in other centres, so that members of these grades may have the advantage of frequent meetings.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. Henry A. Casperd, of 49, Queen Victoria Street, E.C.4 (late of the G.E.C.), is now representing the interests in London and the South-Eastern counties of Messrs. Welch's Patents ("Welco" slotted steel for switchgear frameworks) and of Mr. S. O. Bowker (wiring clips, saddles, &c.).

The name of the proprietor of the White Horse Hotel, Leeds, is Mr. Frank W. Warton, not Larton, as stated last week.

At Whitley Bay, on July 31st, Mr. G. McKenzie Daniels, sales manager of the Electricity Distribution of North Wales and District, Ltd., Wrexham, was married to Miss Helen Thirlaway, of Newcastle-on-Tyne. Mr. Daniels was for seven years on the staff of the Newcastle-on-Tyne Electric Supply Co., as district lighting engineer, while his bride's father was with the Newcastle and Gateshead Gas Co. for 50 years.

Mr. Arthur Cherry, of Hindhead, Haslemere, who since 1908 has been managing director and secretary of the Hindhead and District Electric Light Co., Ltd., which undertaking has been taken over by the Aldershot Gas, Water and District Lighting Co., left on August 17th for Auckland, New Zealand, where he intends to settle.

The marriage took place on August 2nd, at St. John's Church, Burslem, of Mr. LEONARD WILCOX, A.M.I.E.E., of Wednesbury and Burslem, and Miss MARY A. LANE, daughter of the late Mr. F. O. Lane, of Burslem.

On the occasion of his marriage on August 11th to Miss M. WARE, Mr. ROBERT RICHARDSON ROBSON (only son of Mr. W. Robson, electrical engineer, Docks and Marine Department, Newhaven Harbour) received a case of cutlery from his colleagues at the Newhaven Harbour power station.

Mr. W. S. TINSLEY, executive engineer in charge of the Bradford section of the Post Office Engineering Department, who retires from the service on attaining the age limit at the end of October, commenced his connection with the Department in 1885, and he had held engineering positions in Liverpool, Newcastle, and London before going to Bradford 19 years ago.

Mr. C. COPPOCK has resigned his position in charge of the Electrical Testing and Experimental Department of Messrs. J. Stone & Co., of Deptford, and has opened an office at Vernon House, Sicilian Avenue, Southampton Row, W.C.1, to carry on the business of an inspecting electrical engineer.

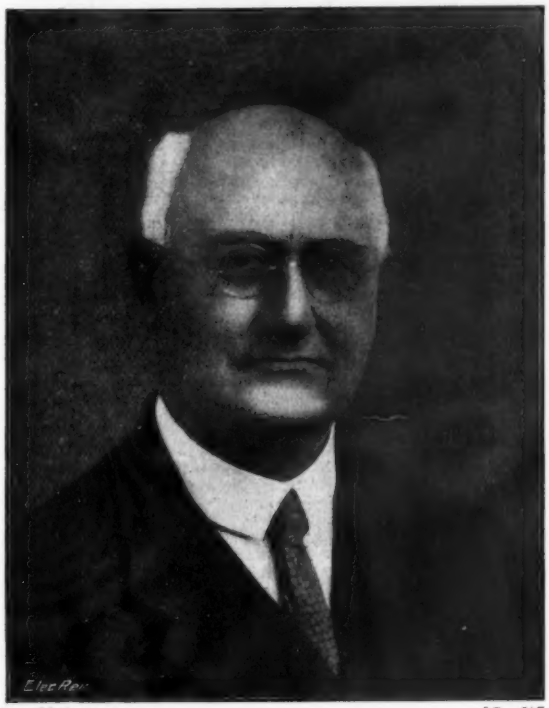
Mr. A. H. DARKER, chief electrical engineer of Messrs. J. Stone & Co., Ltd., of Deptford, who is making a world tour, arrived in Australia from New Zealand in July, and expects to be back in England in November.

Mr. G. B. CROCKATT, late of the Reason Co., is now on the staff of Messrs. Pooley & Austin, and he will be stationed in London dealing mainly with sales of the Lawson mercury motor meter.

On August 14th the Bury St. Edmunds Borough Council appointed Mr. ALFRED E. KNIGHTS (assistant electrical engineer to the Southport Corporation) as its borough electrical engineer, in succession to the late Mr. S. E. Day.

Obituary.—MR. W. A. CHAMEN.—Mr. William Ashcombe Chamen, whose death on August 14th was briefly announced in our last issue, will be greatly missed by many friends both in electrical circles and outside them, for he was a lovable man always ready to lend a helping hand, as well as being of a deeply religious nature. He had a prominent electrical career and was a very busy man; for ordinary recreation he had no time, as he was so devoted to Church work (he was a member of the Governing Body of the Church in Wales), but this brought him real delight which sports often fail to yield to men of such temperament. In a biographical notice of Mr. Chamen's work a few years ago (ELEC. REV., February 29th, 1924, p. 344), when he became president of the South Wales Institute of Engineers, we referred to his inaugural address, in which he expressed the conviction that in the blending of all classes in united effort for the common weal, namely, Christianity, lay the only sovereign remedy for the relief of the industrial situation of the country and the recovery of her former commercial position. His electrical work began in 1879 with Crompton & Co., with whom he spent seventeen years and for whom he carried through many early electric lighting installations in this country and abroad. He became Corporation electrical engineer at Glasgow in 1896, and remained in that city until 1905, during which period the power stations at Port Dundas and St. Andrew's Cross were constructed. He left Glasgow to join Messrs. Bramwell & Harris, the consulting engineers, who were at that time engaged in connection with the South Wales Electrical Power Distribution Co., and Mr. Chamen was appointed engineer and manager of this concern, which appointment he held from December, 1905, until the end of last year, when he joined the board of the company and its associated concern, and Mr. J. W. Beauchamp transferred his attentions from E.D.A. to South Wales.

Mr. Chamen was born in 1864 at New Cross and was educated at Walthamstow. He was thus 64 years of age. Three weeks before his death he went with his family to Rhoose for a holiday, and it was while there that he had a seizure which proved fatal. He has left one son and one daughter. His other son, Lieut. Harold Ashcombe Chamen, who was attached to the 2nd Bedfordshire Regiment, was killed in action in France in 1916. Some 400 mourners, including the family, business colleagues, officials and staff of the South Wales companies, as well as representatives of various electrical, engineering, church and other organisations, and numerous other friends, were present at the service at St. Dyfrig's Church, Cardiff. Mr. A. Page, president, represented



Donald Fraser] *[Cardiff*

The late Mr. W. A. Chamen.

the Institution of Electrical Engineers, and Mr. C. T. Allan, the Western Centre of that body. The burial took place at Weston-super-Mare Cemetery, in a grave beside that of his parents, on Thursday, August 16th, many of Mr. Chamen's former friends and colleagues accompanying the cortège from Cardiff.

MR. J. O. TUCKER.—We have to record the death, which occurred on August 13th, in his 93rd year, of Mr. J. O. Tucker, father of the late Mr. J. H. Tucker, founder of Messrs. J. H. Tucker & Co., Ltd., the well-known switch manufacturers of Birmingham, and grandfather of Mr. J. B. Tucker, the present joint managing director of the company. The interment, which took place on August 13th, was attended by many of the older employés, to whom the deceased was a familiar figure.

MR. R. A. PRITCHARD.—The death occurred on August 5th, at the age of 32 years, of Mr. Raymond Arthur Pritchard, of A. Pritchard & Co., electrical engineers, of High Street, Lye.

MR. THOMAS P. STABLES.—We learn with regret of the death, which occurred on August 19th, after a protracted illness, of Mr. Thomas P. Stables, a director and secretary of Messrs. Rashleigh, Phipps & Co., Ltd., with which business he had been long connected.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Armitage Manufacturing Co., Ltd.—Private company. Registered August 15th. Capital, £200 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio receiving and transmitting sets, television sets, wireless accessories, components and parts; mechanical engineers, metal workers, &c. The subscribers (each with one share) are: Gertrude A. Loton, 1, Martin Lane, E.C.4, clerk; C. W. Longman, 1, Martin Lane, E.C.4, law clerk. Registered office: 9, St. Stephen's House, Victoria Embankment, S.W.

Macinlop (Ireland), Ltd.—Private company. Registered August 15th. Capital, £100 in £1 shares. Objects: To carry on in Northern Ireland and the Irish Free State or elsewhere the business of electrical wire and cable manufacturers, manufacturers of and dealers in india-rubber, gutta-percha and other goods. The subscribers (each with one share) are: G. Conrad, 103, Phyllis Avenue, New Malden, Surrey, solicitor's clerk; H. A. Norton, 26, Barnsbury Park, N., solicitor's clerk. Solicitors: Clifford-Turner & Co., 81-7, Gresham Street, E.C.2.

Electroservice, Ltd. — Private company. Registered August 16th. Capital, £100 in £1 shares. Objects: To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical and wireless apparatus, electric and other lamps, lampshades and fittings, &c. The first directors (to number not less than two nor more than seven) are: A. L. Golding, May Trees, Sylvan Road, Laindon, electrical engineer (managing director); Mrs. L. Golding, same address. Registered office: 3, Waterloo Road, S.E.1.

Mersey Radio and Gramophone Co., Ltd.—Private company. Registered August 16th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with H. A. Woodyer and W. P. Woodyer, and to carry on the business of manufacturers of and dealers in and repairers of, agents for the purchase and sale of and dealers in all kinds of instruments, apparatus, accessories, books, literature and materials used in connection with radio or wireless telegraphy, telephony or television, pianos, gramophones, and musical instruments, &c. The directors are: H. A. Woodyer, 51, Caldy Road, West Kirby, radio engineer; W. P. Woodyer, 28, Ranville Road, Aigburth, Liverpool, radio engineer; W. E. Woodyer, 51, Caldy Road, West Kirby, printer. Qualification: 100 shares. Secretary: C. G. Woodyer. Registered office: 19, Water Street, Liverpool.

Everlite, Ltd.—Private company. Registered August 17th. Capital, £1 in 2s. shares. Objects: To carry on the business of electricians, mechanical engineers, suppliers of electricity, &c. The subscribers (each with one share) are:—W. H. Watford, 10, Lambourne Road, Leytonstone, E.11, solicitor's clerk; W. J. Yeoman, 244, Lordship Lane, East Dulwich, S.E.22, solicitor's clerk; D. F. A. Shayler, 16, Bendemere Road, Putney, S.W.15, solicitor's clerk. In the event of the whole of the shares not being subscribed within one month, the company will be dissolved. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

England-Richards Fluid-Free Cell Co., Ltd.—Private company. Registered August 11th. Capital, £1,000 in £1 shares. Objects: To acquire any patents and rights relating to the production of dry cell electric batteries, &c. The directors (all permanent) are:—V. England-Richards, 23, London Road, Kings Lynn, patentee (chairman); E. M. Hook, address not stated (managing director); J. C. Thornley, 43, Sidney Street, Kings Lynn, incorporated accountant. Secretary: J. C. Thornley.

Lawrie & Co., Ltd.—Private company. Registered August 9th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers and dealers in railway, tramway, electrical, and other apparatus, &c. The directors are:—A. Lawrie, Campfield House, Wellside Place, Falkirk, motor and electrical engineer; J. Harper, Wick, wholesale and retail ironmonger. Qualification, 200 shares. Secretary: J. Harper. Solicitors: W. Georgeson & Son, Wick.

Official Returns of Electrical Companies.

Wakelin's Wireless Co., Ltd.—Mortgage dated August 2nd, 1928, to secure £675, charged on 66, Norwich Road, Ipswich. Holders: Ipswich Permanent Benefit Building Society, Ltd., 8, Princes Street, Ipswich.

X.L.O. Co., Ltd.—W. C. Norrington-Wood, of 6, Farman Street, Hove, ceased to act as receiver or manager on May 26th, 1928. (Notice filed August 15th.)

Electric Construction Co., Ltd.—Capital, £400,000 in 100,000 preference and 300,000 ordinary shares of £1 each. Return dated June 26th, 1928. 62,780 preference and 300,000 ordinary shares taken up. £116,490 paid on 36,490 preference and 80,000 ordinary shares. £246,290 considered as paid on 26,290 preference and 220,000 ordinary shares. Mortgages and charges, £128,380.

South London Electric Supply Corporation, Ltd.—Capital, £750,000 in 50,000 preference and 700,000 ordinary shares of £1 each. Return dated April 12th, 1928. 30,000 preference and 494,000 ordinary shares taken up. £290,000 paid on 30,000 preference and 260,000 ordinary shares. £234,000 considered as paid on 234,000 ordinary shares. Mortgages and charges, nil.

Mirrlees, Bickerton & Day, Ltd.—Capital, £600,000 in 100,000 5½ per cent. cumulative preference and 500,000 ordinary shares of £1 each. Return dated July 6th, 1928. 71,000 preference and 466,000 ordinary shares taken up. £302,500 paid on 71,000 preference and 231,500 ordinary shares. £234,500 considered as paid on 234,500 ordinary shares. Mortgages and charges, nil.

Schall & Son, Ltd.—Capital, £20,000 in 9,000 preference and 11,000 ordinary shares of £1 each. Return dated January 2nd, 1928. 5,000 preference and 9,102 ordinary shares taken up. £502 paid on 102 ordinary and 400 preference shares, £13,600 considered as paid on 9,000 ordinary and 4,600 preference shares. Mortgages and charges at date of return: £12,000 (£8,000 paid off in April, 1928). Since registered: Land Registry charge dated April 23rd, 1928, to secure £8,000.

Tricity Restaurants, Ltd.—Debenture dated August 2nd, 1928, to secure £10,000, charged on the company's property, present and future, including uncalled capital. Holders: British Electric Transformer Co., Ltd., Hayes.

Patent Conveyor Co., Ltd.—J. R. Watson, of 5-9, Old Bank Chambers, Cheapside, Bradford, ceased to act as receiver or manager on August 7th, 1928.

Rangoon Electric Tramway and Supply Co., Ltd.—Satisfaction to the extent of £300 on April 30th, 1928, of debenture stock dated February 1st, 1906, and January 25th, 1924, securing £250,000.

Rushden and District Electric Supply Co., Ltd.—Issue on April 17th, to July 28th, 1928, of £4,800 debentures, parts of a series already registered.

Collier & Illingworth, Ltd.—Capital, £1,000 in £1 shares. Return dated March 29th, 1928. 400 shares taken up. £400 paid. Mortgages and charges, nil.

Walter Denis Manufacturing Co., Ltd.—Capital, £500 in £1 shares. Return dated December 28th, 1927 (filed March 1st, 1928). 261 shares taken up. £2 paid, £259 considered as paid. Mortgages and charges: £1,850.

Radiovim, Ltd.—Capital, £1,500 in £1 shares. Return dated June 25th, 1928. All shares taken up. £1,500 paid. Mortgages and charges, nil.

R. Alger & Sons, Ltd.—Capital, £20,000 in 5,000 cumulative preference and 15,000 ordinary shares of £1 each. Return dated November 14th, 1927 (filed February 2nd, 1928). 3,000 preference and 11,960 ordinary shares taken up. £4,960 paid on 3,000 preference and 1,960 ordinary shares, £10,000 considered as paid on 10,000 ordinary shares. Mortgages and charges, nil.

Electricity (Hull), Ltd.—Capital, £2,000 in £1 shares. Return dated December 5th, 1927 (filed February 25th, 1928). 700 shares taken up. £700 paid. Mortgages and charges, nil.

Thalberg Halstead, Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1928. All shares taken up. £630 paid, £370 considered as paid. Mortgages and charges, nil.

R. F. Winder, Ltd.—Capital, £12,000 in £1 shares. Return dated June 25th, 1928. 10,300 shares taken up, £10,300 paid. Mortgages and charges: £5,000.

New Wilson Electrical Manufacturing Co., Ltd.—Capital, £500 in 400 preference shares of £1 each and 2,000 ordinary shares of 1s. each. Return dated August 11th, 1927 (filed February 6th, 1928). All shares taken up. £500 paid. Mortgages and charges, nil.

Lincoln Wireless Co., Ltd.—Capital, £1,200 in £1 shares. Return dated November 29th, 1927 (filed February 24th, 1928). 700 shares taken up, £700 paid. Mortgages and charges, nil

Betax Manufacturing Co., Ltd.—E. Lever, of Chiswell House, Finsbury Pavement, E.C.2, was appointed receiver and manager on July 18th, 1928, under powers contained in charge dated November 16th, 1925.

Euradic Electric Co., Ltd.—B. R. Brewster, of 7, Bishops Road, Paddington, was appointed receiver and manager on August 8th, 1928, under powers contained in debentures dated October 19th, 1925.

Insulated Cap and Rivet Co., Ltd.—F. W. Kellaway, of 231-2, Strand, W.C.2, ceased to act as receiver and manager on August 11th, 1928.

Shoreham and District Electric Lighting and Power Co., Ltd.—Particulars filed of £10,000 debentures authorised May 22nd, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,200 (August 1st).

B.M.A.S., Ltd.—J. Collier, of King's House, 42, King Street West, Manchester, ceased to act as receiver or manager on July 29th, 1928.

Samdon Wireless Co., Ltd.—Debenture dated July 24th, 1928, to secure £200 charged on the company's property, present and future, including uncalled capital. Holder: M. Morris, "Woodcroft," Broom Lane, Higher Broughton.

Brownie Wireless Co. of Great Britain, Ltd.—Debenture charged on property at Mornington Crescent, W., and the company's undertaking and property, present and future, including uncalled capital, dated August 1st, 1928, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Red Triangle Electric Co., Ltd.—First mortgage debenture dated July 27th, 1928, to secure £400, charged on the company's property, present and future, including uncalled capital. Holder: A. E. Chapman, 125 Stanley Park Road, Carshalton.

Macos Battery Manufacturing Co., Ltd.—R. H. Dutchman, of 122-3, Moorgate Station Chambers, E.C.2, ceased to act as receiver on July 30th, 1928.

Uneeda Supplies Co., Ltd.—W. F. Baker, of 93, Mortimer Street, W.1, was appointed receiver and manager on August 1st, 1928, under powers contained in first charges dated May 2nd and 30th, and June 18th, 1927.

Bussey & Sabberton Bros., Ltd.—Two mortgages, both dated July 14th, 1928, to secure £1,300 and £700, respectively, charged on freehold garage and premises next Waggon and Horses Lane and Wensum Street, Norwich. Holders: Mrs. M. Crotch, 4, Brunswick Road, Norwich; A. Crotch, 17, Westthorpe Street, Putney, S.W.15; and E. E. Blyth, 11, Upper King Street, Norwich.

Power Wireless, Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated December 31st, 1927 (filed March 2nd, 1928). 1,000 preference and 30 ordinary shares taken up. £1,030 paid. Mortgages and charges nil.

W. Robson & Sons, Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1927 (filed March 16th, 1928). 400 shares taken up. £300 paid. £100 considered as paid. Mortgages and charges £600.

Budleigh Salterton Electric Light and Power Co., Ltd.—Capital, £6,000 in £1 shares. Return dated July 9th, 1928. 1,002 shares taken up. £1,002 paid. Mortgages and charges at date of return, £5,000. Debenture created July 17th, 1928 (ranking *pari passu* with above £5,000), £2,000.

Central Electric and Radio Co., Ltd.—Capital, £500 in £1 shares. Return dated February 25th, 1928. 112 shares taken up. £112 paid. Mortgages and charges, £1,050.

St. Andrews Electric and Radio Co., Ltd.—Capital, £350 in £1 shares. Return dated August 25th, 1927 (filed March 19th, 1928). 111 shares taken up. £111 paid. Mortgages and charges nil.

Bell's (Yorks.), Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1927 (filed March 20th, 1928). All shares taken up. £100 paid. Mortgages and charges nil.

Magnus Volk, Ltd.—Capital, £5,000 in £1 shares. Return dated May 31st, 1928. 4,102 shares taken up. £102 paid. £4,000 considered as paid. Mortgages and charges, £500.

Woodstock Power Syndicate, Ltd.—Capital, £3,000 in £1 shares. Return dated January 4th, 1928. 211 ordinary shares taken up. £211 paid. Mortgages and charges, £2,300.

Whitchurch and Pangbourne Electric Supply Co., Ltd.—Capital, £10,000 in 300 preference and 1,700 ordinary shares of £5 each. Return dated May 28th, 1928. 1,700 ordinary shares taken up. £8,500 paid. Mortgages and charges nil.

City Notes.

Puebla Tramway, Light and Power Co.

The directors' report for the year ended December, 1927, states that net profits in Mexico amounted to $1,372,377 Mex., as compared with $1,464,683 Mex. in 1926, and such profits converted into sterling at 24.5d. per peso are equivalent to £140,097. The *Financial News* states that provision has been made for all accounts considered doubtful of collection and for contingencies, and after charging all expenses, interest and sinking funds on prior lien and first mortgage bonds and 8 per cent. note service, there is a balance of £12,427, which has been carried to the balance-sheet. Notwithstanding general depression in the industry of the country, and particularly in the cotton industry, light and power receipts during the year showed a satisfactory increase. Operating expenses were considerably higher than in the previous year, and included a considerable amount for losses on exchange. "Owing to silver being at a discount compared with gold, and to the fact that Mexican gold was also below U.S. parity, a considerable exchange loss on remittances between Mexico and New York was incurred. Since the date of the balance-sheet an agreement has been entered into with the Municipality of Puebla, which provides for regular payment in future of their light and power accounts and liquidation over a period of outstanding indebtedness. Extension of the electrification of the Mexican Railway from Cordoba to Paso del Macho was completed in May of this year, and additional power is now being delivered."

Edmundsons' Electricity Corporation, Ltd.

An extraordinary meeting was called for yesterday (Thursday) to consider a resolution for the increasing of the capital to £1,650,000 by the creation of 850,000 ordinary shares of £1 each. It is also proposed to capitalise £600,000 of undivided profits, which will be utilised in paying up an equivalent amount of the new shares. These paid-up shares will be allotted to the present ordinary shareholders in proportion to their holdings. The balance of the new shares (250,000) will be offered at par to the existing ordinary shareholders, and the proceeds will be devoted to the redemption of the outstanding debenture stock. The holders of the company's 4½ per cent. first debenture stock have been notified that their holdings will be redeemed on November 15th.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

International Aluminium Co., Ltd.—50,750 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 100,001 to 150,750.

Postal Telegraph & Cable Corporation.—£7,195 5 per cent. collateral trust debenture stock and fractional scrip certificates. $1,625 5 per cent. collateral trust gold bonds and fractional scrip certificates.

Fellows Manufacturing Co., Ltd.

The directors have decided to make December 31st the end of the company's financial year, instead of July 31st as at present; thus the current accounts will cover a period of about 17 months. It is stated that sales have continued to increase, and a further advance is expected in the autumn, when the directors hope to declare interim dividends on both classes of shares.

Clontarf and Hill of Howth Electric Railroad Co.

Dividend of 3 per cent. per annum (3s. per share).

Clyde Valley Electrical Power Co.

Interim dividend on ordinary shares of 3 per cent., actual, less tax.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets find a good deal of business going on, more particularly amongst investment issues, although it may be said that speculation also is reviving as the end of the holiday season draws near. People are beginning to come back to town and the usual question is, what can they buy in order to make a little money with which to fill up the gaps created in their bank balances by holiday requirements? Psychologically speaking, when a man feels fit he is usually willing to take a cheerful view of the outlook, and to put money into stocks and shares which perhaps might not have the same attraction for him at moments of depression. The general prospect is favourable to the holder of good class securities, inasmuch as money continues plentiful owing, unfortunately, to the fact that the national trade is none too brisk. There is still talk of a possible rise in the Bank Rate, but this exercises no particular influence over the prices of Stock Exchange securities.

Home Rails.

A feature amongst Home Railway stocks is a further rise of 3 in the income debentures and of 1s. in the £1 shares of the Underground Railways of London. The former have risen to 130, the latter to 27s. It is said in the Stock Exchange that the buying is mainly from two or three particular sources, but in any case it is persistent, and the floating supply of shares and stocks is very limited. On paper, the prices of both issues look fairly well valued, for, as we have mentioned on previous occasions, the last-paid 5 p.c. dividend on the shares is not expected to be exceeded to any dramatic extent in respect of the current year, though 7 p.c. is forecast by some of the optimists. Other Tube Railway stocks are steady, Districts being 10s. higher. Metropolitan consolidated is quoted ex the interim dividend.

Power and Traction.

The market for Canadian utility issues is irregular. Hydro-Electrics have been active, rallying from 26 to 29. International Holdings, on the other hand, have been very quiet around 12. Brazilian Traction shares, which dipped to 53, have recovered to 56½, and Barcelona Tractions are better on the week at 64. Mexico Tramway Common have risen to 33, and although they are regarded as being a useful speculation, the cautious folk ask how long it is likely to be before any dividend is paid on the shares. And the answer, it may be observed, is usually indefinite. Bermuda Traction 7 p.c. debenture remains at 4½ discount. The shares have moved up to 13s.—twice the price at which the market in the shares started a month ago.

"Capital Appreciation."

Reference has just been made to the abundance of capital that is available for investment and for speculation in the Stock Exchange. Talk continues to be current as to the likelihood of many rates becoming stiffer, though, if they do, this is not likely to affect securities other than those in the purely gilt-edged markets. Ordinary stocks and shares in many cases pay so meagrely on the money that the yield may be almost said to go for little or nothing, the main idea of buyers being to put cash into such stocks and shares as are likely to show capital appreciation in the more or less near future.

Provincial Electricity.

There is a decided run at the present time upon the shares of provincial electric lighting and power undertakings. Reasons have been advanced here on many previous occasions to account for the partiality with which such shares have been regarded for at least a couple of years by the investor who looked ahead and foresaw the prospects which extension of electrical power all over the country would brighten. During that period, the absorption of shares, &c., has been steady and continuous. It is a well-known fact that a Stock Exchange market cannot become popular unless there are plenty of its shares in which to deal, because, if a man finds he is unable to obtain what he requires from one department, he will direct his capital into something else. As it happens, the provincial lighting and power companies have made a good many new issues for the extension and development of their business, with the result that there has generally been a reasonable supply in the market, and the buyer has found he could get what he wanted. This supply is beginning to run short now, and continued pressure to invest money in the stocks and shares begins to show its influence in the rises that have occurred during the past month. Within the week with which we deal, a number of fresh improvements have taken place, and amongst other shares that have moved up may be mentioned Bournemouth and Poole 62s. 6d., Isle of Thanet 37s. 6d., Shropshire 35s., Scottish Power 33s., Yorkshire Power 36s., Lancashire Electric 30s., Egham and Staines 39s. 6d. Midland Counties have gained 1s. 6d., at 31s. 6d.; the new shares are relatively a little cheaper. Electric Supply Corporation shares are up 2s. 6d., to 50s. Urbans had a jump of 3s. 9d. to 35s. Midland Electric Power Corporation shares have retained last week's brisk rise to 43s. 9d.

London Lighting Shares.

London Electric preference are ½ higher at 5⅛; County of London strengthened to 38s. 6d. Charing Cross ordinary and preference have recovered the dividends deducted on August 16th. Metropolitans rose to 48s. 9d. ex dividend. The market presents a hard appearance and there is not much of a choice for the buyer who wants the best-class London companies' shares.

Shares on Offer.

Ordinary shares in undertakings which deal with various classes of electrical work are popular at present. Crompton-Parkinson 6 p.c. preferred ordinary are up to 18s. Power Securities ordinary cost 31s. 6d., at which the yield, on the basis of the last-declared 7 p.c. dividend, is £4 8s. 9d. p.c. Kalgoorlie Electric Power Corporation 10s. ordinary shares are obtainable at about their par price. Brush ordinary are offered at 39s., and Atlas Light & Power ordinary at 20s. 3d. A few thousand pounds River Plate Electric ordinary stock should come at 225 or rather less. A thousand Delhi Electric Supply and Traction ordinary are on offer at 2 9/16. The last dividend was 12 p.c., which gives a yield of £4 13s. 6d. p.c. on the money. British Electric Transformer ordinary £1 shares at 13s. afford £7 13s. 9d. p.c. The dividends for the past two years were 5 p.c. in each: for 1925 nothing was paid. Richmond (Surrey) ordinary at 41s. return 4¼ p.c.; Egham and Staines at £2 pay 3¾ p.c. We are mentioning the prices at which the shares happen to be on offer: probably sellers might prove open to the temptation of rather lower bids if the shares have not been taken by the time that this journal appears.

Cable Stocks.

The Eastern group is dullish, with falls of 5s. apiece in Eastern Extension, Western & Globe ordinary shares. Eastern Telegraph ordinary is left at 245 middle. The company's 3½ p.c. preference has risen to 67½, Eastern Extension 4 p.c. debenture to 79½, and Commercial Cable 4 p.c. debenture to 80. The feature in this group is the strength of the Anglo-American stocks. International Telephone & Telegraph put on 7 to 180; American Telephone & Telegraph passed it by half a point. Anglo-American Telegraph 6 p.c. preferred gained 2½, rising to 103: the deferred at 24¼ is the fraction harder. International Automatic Telephones are up to 40s., but Automatics have not changed from 43s. 9d. United River Plate Telephones are no better after their drop to 9¼. Great things are hoped from the visit of the company's chairman to see what he can do in the way of settling the matters in dispute.

Manufacturing and Others.

Apart from ¼ fall in Henleys to 5½, there is not much change in the manufacturing section. Siemens are better at 28s. 3d. Metropolitan-Vickers keep good at 32s. 6d. on statements that the company has been successful in securing important contracts. In the engineering section, Vickers have improved to 12s.: there is more willingness than heretofore to buy the pre-ordinary issues of iron, coal and steel companies. Rubber shares are mending, despite an almost uninteresting state of affairs in the market for the raw product. The wireless group is placid. Marconi debenture shed 5 points to 155. Proprietors may consider somewhat superfluous a reminder that they must convert their debentures into shares early next month—unless they want to lose a lot of money.

Share List of Electrical Companies.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price Aug. 20, 1928.	Rise or fall.	Yield. p.c.
Home Electricity Companies.	£					
Bournemouth and Poole	1	14†	15	3⅛xd	+2/-	... ...
Brompton Ordinary	1	8⅜	8½	26/6	—	5 5 8
Charing Cross Ordinary	1	8½	8½	27/-xd	+9d.	5 3 8
do. do. 4½% Pref.	1	4½	4½	17/6xd	+4½d.	5 2 10
Chelsea	1	8⅛	8⅛	26/6	—	5 5 8
City of London	1	10	10	30/9	—	4 11 1
do. do. 6% Pref.	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	37/6	+6d.	4 5 3
County of London	1	7½	7½	38/6	+6d.	3 18 3
do. do. 6% Pref.	1	6	6	23/6	—	5 2 2
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	2½	+⅛	4 8 0
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	+1/-	5 0 0
London Electric	1	8½	8½	27/6	—	5 1 10
Metropolitan	1	8	9	2⅞xd	+2/-	3 13 9
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	31/6	+1/6	4 2 6
Mid. Elec. Power	1	—	15	43/9	—	... ...
Newcastle-on-Tyne Ordinary	1	5	6	25/9	+9d.	4 13 2
do. 7% Pref.	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/-	+1/6	4 17 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	35/-	+3/9	... ...
Westminster Ordinary	1	8½	8½	27/-xd	—	5 3 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	36/-	+1/-	4 9 9
Home Rails.						
Central London Ord. Assented	Stock	4	4	73	—	5 9 7
Metropolitan	,,	3	3	66½xd.	—	4 10 3
do. District	,,	3½	4	77½	+½	5 3 3
Underground Electric	£1	1½	5	27/-xd	+1/-	3 14 0
do. do. Income	Bonds	6	6	130	+3	4 12 4
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	+2½	5 16 5
do. Def.	,,	1½	1½	24¼	+¼	6 3 9
Automatic Telephone	1	10	10	43/9	—	4 9 0
Eastern Extension	10	10	10	24½	—¼	*4 2 8
Eastern Tel. Ord.	Stock	10	10	245	—	*4 1 8
Globe Tel. and T. Ord.	10	10	10	24½	—¼	*4 2 8
do. do. Pref.	10	6	6	11⅛	—	5 7 10
Great Northern Tel.	10	20	20	38	—	5 5 3
Indo-European	25	10	10	45⅛	—	*5 10 0
Marconi	10/-	5	*10	3⅛	—	... ...
Marconi-Marine	1	8½	12½	51/-	—	4 18 1
Oriental Telephone Ord.	1	12	12	53/9	—	*4 9 3
United R. Plate Tel.	5	8	8	9¼	—	*4 2 1
Western Telegraph	10	10	10	24½	—¼	4 2 8

*Interim.

Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8⅜	—	7 11 9
do. do. 2nd. Pref.	5	6	6	8⅛	—	8 11 6
do. do. 5% Deb.	Stock	5	5	78⅛	—	6 7 5
British Electric Traction Def. Ord.	,,	—	—	520	—	... ...
do. do. Pref. Ord.	,,	8	7½	125	—	6 0 9
Brazil Traction	100	6	7	56½	+4	3 2 0
Brit. Colombia Elec. Rly. Pcc.	Stock	5	5	96½	—	5 3 9
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/6	—	... ...
London United Tram Deb.	Stock	4	4	60½	—	6 12 3
Mexico Trams, 5% Bonds	—	5	5	79	—2	6 6 7
Mexican Light Common	100	Nil	Nil	71	—	... ...
do. 7% Pref.	100	Nil	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	80½	—	6 4 3
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	13	15	67/6	—	*4 9 0
British Aluminium Ord.	1	10	10	2⅛	—	*4 11 6
British Elec. Transformer Pref.	1	7	7	18/-	—	7 15 0
British Insulated Ord.	1	15	15	4½	—	3 10 6
Brush Ord.	1	10	10	28/3	—	7 2 10
Callenders	1	15	15	4⅞	—	3 12 6
do 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Pref Ord.	1	—	6	17/6	—	6 17 2
do. 8% Pref.	1	—	8	26/3	—	6 2 0
Edison-Swan	4/-	10	10	12/6	—	3 4 0
do. 5% Deb.	Stock	5	5	88	—	5 18 8
Electric Construction	1	7½	7½	27/6	—	5 9 1
Enfield Cable Ord.	1	20	20	4⅜	—	4 11 6
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref	1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	5 6 1
do. Ord.	1	7½	10	38/6	—	5 4 0
Henley	1	25	25	5½	—¼	4 11 0
do. 4½% Pref.	5	4½	4½	4⅞	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	2	—	5 0 0
Met.-Vickers Ord.	1	8	6	32/6	—	3 13 10
do. Pref.	2	8	8	2⅜	—	6 1 11
Siemens Ord.	1	7½	7½	28/3	+9d.	5 6 1
Telegraph Construction	12	10	10	24½	—	*4 18 6

*Dividends paid free of Income Tax.

†4% of which was tax free.

Our Foreign Electrical Trade.

Electrical Exports and Imports during July, 1928.

THE Board of Trade returns of foreign trade during July are, from an electrical point of view, not so good as might have been expected. As compared with the previous month, electrical exports declined by £163,971; the decrease was general, there being only four increases—none of great moment. The greatest fall occurred in the case of telegraph and telephone apparatus (£50,129), but insulated wire and cable exports decreased by about the same amount (£48,758). There were decreases in all three machinery items, and the total decline in this section amounted to £66,646. Unenumerated goods and apparatus recorded the greatest increase (£9,057). The comparison with July, 1927, is a much better one, although the total again shows a decrease of £10,533. A substantial increase is shown against unenumerated goods and apparatus, amounting to about 32 per cent. Insulated wires and cables were also higher. The machinery exports as a whole were about £5,000 in excess of those of July, 1927, falls in unenumerated machinery and traction motors being more than compensated for by increased exports of "other" motors and generators. The telegraph and telephone section showed a decline of about £67,000; the only other substantial decrease was one of £21,437 in the case of batteries and accumulators. In spite of the reduction in the total exports, the shipments for the completed portion of the year have been higher by £24,636 than those for the corresponding period of 1927.

The imports again showed a rise, making the increase for the first seven months of the year over £350,000. The month's total was £11,000 above that of June, mainly on account of rises of £15,487 in imports of unenumerated electrical machinery and £7,622 in the case of glow lamps. The decreases included one of £8,000 in unenumerated goods and apparatus and another of £2,838 in non-submarine telegraph and telephone wires and cable. As compared with July, 1927, there was an increase of £39,305, there being outstanding rises in insulated wires and cables (£19,722), telegraph and telephone apparatus (£19,395), and unenumerated electrical machinery (£15,513). The two principal decreases, each over £10,000, were recorded against batteries and accumulators and glow lamps.

The re-exports fell by about a third as compared with the June figure, although they were £5,643 higher than in July, 1928.

The following table shows the distribution of our electrical machinery exports during July, comparing the figures with those of the corresponding month of last year:—

Destination.	July, 1927. £	July, 1928. £	Inc. or dec. £
European countries ...	93,206	105,402	+12,196
Japan	32,093	13,629	−18,464
South America	24,665	59,966	+35,301
South Africa	60,064	49,772	−10,292
British India	87,337	118,548	+31,211
Australia	149,819	96,195	−53,624
New Zealand	39,137	27,567	−11,570
Canada	12,187	15,780	+ 3,593
Other countries	44,904	59,758	+14,854
Totals	£543,412	£546,617	+£3,205

During the first seven months of the year our exports of electrical machinery have risen from £3,930,753 to £4,003,408. There have been substantial increases in the shares of South America, India, and "other countries," but South Africa has taken less than half the value with which it was credited in the corresponding period of 1927, and the amount imported by Australia has also decreased considerably.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for July, 1928.	Inc. or dec. as compared with June, 1928.	Inc. or dec as compared with July, 1927.	Electrical imports for July, 1928.	Inc. or dec. as compared with June, 1928.	Inc. or dec. as compared with July, 1927.	Electrical re-exports for July, 1928.	Inc. or dec. as compared with June, 1928.	Inc. or dec. as compared with July, 1927.
Electrical goods and apparatus (unenumerated)	£218,194	+ £ 9,057	+ £53,146	£108,446	− £8,008	+ £ 7,289	£6,817	− £2,561	+ £2,090
Insulated wires and cables ...	234,048	− 48,758	+ 19,067	70,802	+ 1,254	+ 19,722	696	− 734	+ 72
Glow lamps	42,457	− 2,100	− 31	33,482	+ 7,622	− 10,262	734	- 151	− 1,212
Arc lamps and parts ...	1,373	− 3,501	+ 281	2,807	− 354	− 1,155	8	+ 4	+ 4
Batteries and accumulators ...	98,331	+ 4,306	− 21,437	40,333	+ 1,203	− 10,803	300	− 366	− 681
Meters and instruments ...	31,843	+ 366	+ 986	25,572	− 1,889	+ 7,342	895	+ 324	+ 162
Carbons	267	− 73	− 729	7,105	− 282	− 4,779	86	+ 69	+ 24
Switchboards (not telegraph or telephone)	5,834	+ 1,373	+ 1,858	3	− 320	− 20	—	—	− 3
Electrical Machinery—									
Electrical machinery (unenumerated)	320,535	− 34,126	− 23,446	150,251	+ 15,457	+ 15,513	11,327	− 8,776	+ 5,695
Railway and tramway motors	25,523	− 19,425	− 2,090	—	—	—	—	—	—
Other motors and generators ..	200,559	− 13,095	+ 28,741	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	58,840	− 165	− 16,046	1,988	− 2,838	− 2,931	74	+ 58	− 86
Submarine telegraph and telephone cable	8,211	− 7,701	− 24,976	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	164,965	− 50,129	− 25,857	44,816	− 844	+ 19,395	2,540	+ 58	− 422
Totals	£1,410,980	−£163,971	− £10,533	£485,605	+ £11,001	+ £39,305	£23,477	−£12,075	+ £5,643
		Exports.			Imports.			Re-Exports.	
Increases for first seven months.		+£24,636			+£351,594			+£42,771	

Electrical Imports and Exports of Canada.

Statistics for 1926-27 and 1927-28 Compared.

THE following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1928, are taken from the recently-issued trade statistics. Figures for the year 1926-27 are given for purposes of comparison, and notes of any increases or decreases have been added :—

Imports.

	1926-27. Thous. $	1927-28. Thous. $	Inc. or dec. Thous. $
Copper wire, plain, tinned, or plated—			
Total	116	117	+ 1
From United Kingdom	8	2	– 6
,, United States	107	115	– 8
Copper wire, covered, including cable—			
Total	563	497	– 66
From United Kingdom	72	12	– 60
,, United States	489	481	– 8
Electric batteries, primary—			
Total (mainly from United States)	164	154	– 10
Electric batteries, storage—			
Total	717	527	– 190
From United Kingdom	327	236	– 91
,, United States	389	290	– 99
Electric fans—			
Total	69	117	+ 48
From United States	68	114	+ 46
Electric fuses, fuse plugs, and cut-outs—			
Total (mainly from United States)	193	221	+ 28
Lightning arrestors, choke coils, &c.—			
Total	75	58	– 17
From United Kingdom	11	—	– 11
,, United States	64	57	– 7
Rheostats, controllers, &c.—			
Total	344	566	+ 222
From United Kingdom	60	51	– 9
,, United States	284	515	+ 231
Sockets, outlets, and receptacles—			
Total	261	334	+ 73
From United States	248	321	+ 73
,, Japan	13	*	*
Spark plugs, magnetos, and other ignition apparatus—			
Total	659	748	+ 89
From United States	654	732	+ 78
,, United Kingdom	6	14	+ 8
Electric cooking and heating apparatus—			
Total	162	251	+ 89
From United Kingdom	1	3	+ 2
,, United States	161	238	+ 77
Dynamos and generators—			
Total	1,178	1,329	+ 151
From United Kingdom	268	390	+ 122
,, United States	835	924	+ 89
,, Sweden	75	6	– 69
Electric light fixtures—			
Total	709	814	+ 105
From United Kingdom	9	15	+ 6
,, United States	679	772	+ 93
,, Germany	6	*	*
Electric meters—			
Total	398	347	– 51
From United Kingdom	63	19	– 44
,, United States	334	327	– 7
Arc lamps—			
Total (mainly from United States)	36	49	+ 13
Incandescent lamps—			
Total	348	320	– 28
From United Kingdom	3	1	– 2
,, United States	98	78	– 20
,, Belgium	3	*	*
,, Germany	30	15	– 15
,, Japan	146	172	+ 26
,, Holland	17	6	– 11
Self-contained lighting sets—			
Total	31	54	+ 23
From United Kingdom	6	8	+ 2
,, United States	25	46	+ 21
Electric motors—			
Total	2,404	2,964	+ 560
From United Kingdom	468	495	+ 27
,, United States	1,918	2,308	+ 390
,, Sweden	13	*	*
Switches, switchboards, circuit breakers, and parts—			
Total	1,275	1,420	+ 145
From United Kingdom	72	86	+ 14
,, United States	1,158	1,330	+ 172
,, Switzerland	42	3	– 39
Telephone and telegraph instruments—			
Total	1,102	1,080	– 22
From United Kingdom	217	79	– 138
,, United States	885	999	+ 114
Transformers—			
Total	289	275	– 14
From United Kingdom	24	20	– 4
,, United States	249	237	– 12
Radio valves—			
Total	134	210	+ 76
From United Kingdom	22	24	+ 2
,, United States	106	183	+ 77
Radio apparatus, n.o.e.—			
Total	2,578	3,491	+ 913
From United Kingdom	96	104	+ 8
,, United States	2,461	3,384	+ 923
,, Germany	1	*	*
Electrical apparatus, n.o.e.—			
Total	3,803	3,715	– 88
From United Kingdom	151	188	+ 37
,, United States	3 589	3,486	– 103
Electric vacuum cleaners—			
Total (mainly from United States)	104	181	+ 77
Total electrical apparatus†	16,932	19,044	+2,112
From United Kingdom	1,807	1,740	– 67
,, United States	14,596	16,762	+2,166

* Not specified.

Exports.

	1926-27. Thous. $	1927-28. Thous. $	Inc. or dec. Thous. $
Batteries, telegraph and telephone apparatus—			
Total	430	371	– 59
To United Kingdom	2	16	+ 14
,, United States	39	29	– 10
,, Newfoundland	9	14	+ 5
,, Australia	24	7	– 17
,, New Zealand	170	111	– 59
,, Spain	10	—	– 10
,, Sweden	3	—	– 3
,, Cuba	42	40	– 2
,, Brazil	72	93	+ 21
Dynamos, generators, and motors—			
Total	74	26	– 48
To United Kingdom	1	—	– 1
,, United States	22	17	– 5
,, Newfoundland	44	3	– 31
Electric cooking and heating devices—			
Total	589	576	– 13
To United Kingdom	9	28	+ 19
,, New Zealand	410	302	– 108
,, Australia	61	74	+ 13
Sparking plugs, magnetos, &c.—			
Total	319	433	+ 114
To United Kingdom	58	179	+ 121
,, Australia	123	101	– 22
,, India	25	38	+ 13
Electrical apparatus, n.o.e.—			
Total	287	443	+ 156
To United Kingdom	56	70	+ 14
,, United States	37	45	+ 8
,, Australia	15	88	+ 73
,, Japan	32	73	+ 41
,, Mexico	72	54	– 18
,, Newfoundland	31	41	+ 10
,, New Zealand	11	27	+ 16
Electric vacuum cleaners—			
Total	29	35	+ 6
To United Kingdom	21	25	+ 4
Total electrical apparatus†	1,698	1,849	+ 151
To United Kingdom	126	292	+ 166
,, United States	108	98	– 10

† Not including vacuum cleaners.

A Steel-Wire Manufactory.

Some notes on the electrical driving equipment at the Bromford Mills, Erdington, of Messrs. Abel Rollason & Sons, Ltd.

THE manufacture of cast-steel wire for ropes, high-grade spring wire and steel music wire is a highly specialised business, and as these products had their inception in a Birmingham works which has recently been extensively re-equipped, some details of the new plant may be of interest.

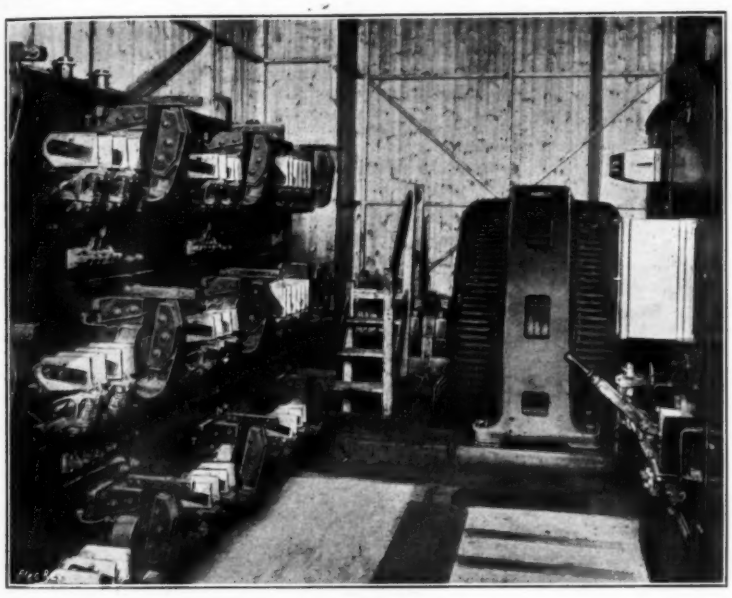


Fig. 1.—1,100-h.p. Motor and Control Gear and Incoming Switchgear.

The works in question are the Bromford Mills, Erdington, owned by Messrs. Abel Rollason & Sons, Ltd., and are claimed to be practically unique in having complete control of every process from the steel furnace to the finished wire.

One of the points of interest in connection with the mills is that they are capable of rolling steel with a carbon content of up to 1 per cent., and the arrangement of the bolting and finishing mill is worthy of note. This mill is driven by a 1,100-h.p. slip-ring induction motor made by the British Thomson-Houston Co., Ltd., 5,000 V, three-phase, 25 cycles, 245 r.p.m., there being a 3-high 12-in. bolting mill driven direct, and a 3-high eight-stand 10-in. finishing mill driven at approximately 410 r.p.m. through oil-immersed double helical speed-increasing gear. The motor and control equipment for this mill is shown in fig. 1. The motor is equipped with two ring-lubricated journal pedestal bearings, each fitted with a thrust facing so that thrust in either direction can be taken. Connection at one end of the shaft is made to the bottom roll of the first stand of the bolting mill by means of a mill-type wobbler coupling, and at the other end to the "Power Plant" speed-increasing gear by a "Wellman Bibby" flexible coupling. For connecting the higher-speed shaft to the mill rolls a special cast-steel coupling is used. The portion keyed to the motor shaft has internal teeth, which engage external teeth on the mill portion, this being of cruciform shape in the middle for the wobbler bar.

The motor is started up by means of a contactor starting panel operated from a master controller, which, together with the incoming switchgear, is installed in the motor house. By means of this equipment the motor may be run in either direction, so that should a jam occur in the rolls it may be readily cleared. In such an emergency the mill can be shut down by means of "stop" pushes in convenient situations about the mill.

The incoming electrical supply from the Birmingham Corporation mains is controlled by switchgear consisting of two truck-type units, one for forward running of the motor and one for reverse; this switchgear and the whole of the control gear were supplied by the B.T.-H. Co. The equipment of each of the main truck units includes an oil-immersed circuit breaker with three time-limit overload trips and low-voltage release, the handles of the switches being suitably interlocked. In addition, there is an ammeter, integrating watt-hour meter, and chart recording watt-meter. A truck-cubicle houses current and potential transformers for the contactor coils and notching relays, isolating switches being provided in the primary circuit of the potential transformer. The cubicles are shown on the right of fig. 1. The pedestal-type master controller for the contactor gear has three main positions; the first permits 40 per cent. full-load current to pass, the second full-load current, and the third allows the contactors to close automatically under current-limit control. The direction of rotation of the motor is dependent on the "forward" or "reverse" stator circuit breaker being closed, the master controller being then used for starting up and for "inching."

Some points in connection with the operations subsequent to those of rolling may now be mentioned briefly: first, the wire is subjected to a continuous patenting process, then cleaned, and after passing through single-hole machines, is finally drawn through dies in three-hole continuous machines down to the desired gauge. A special feature is that the wire-drawing machines are driven by motors having a very wide speed variation; those shown in fig. 2 are rated at 25 h.p., and run at from 530 to 1,060 r.p.m. They are B.T.-H. d.c. motors operating on a 220-V circuit, and are controlled by pillar-type contactor starting equipment (operating under current-limit control) with push buttons for starting, stopping and inching, the speed variation being obtained by shunt-field regulation. An isolating switch is incorporated in these starting pillars, and as overload relays are included, full protection is given, since protection against under-voltage is, of course, an inherent feature. Should the voltage fall, the contactors would open and not reclose until the "start" push button was operated.

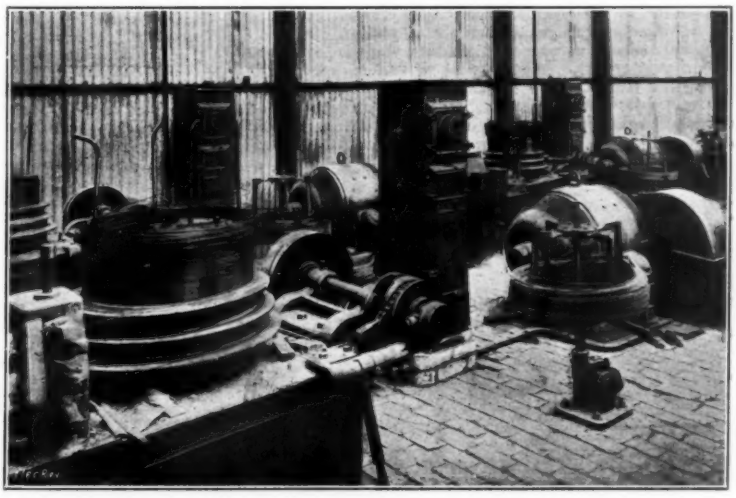


Fig. 2.—Wire-drawing Department, showing Variable-speed Motors and Control Equipment.

By using these variable-speed motors the capacity of the wire-drawers is increased, as the finer the wire the faster may the machines be operated. Another feature of these machines is that the elongation of the wire after each die is taken up automatically by means of a differential driving each block separately.

Magnetising Permanent Magnets.

An Outline of a Simplified Practical Method which has been Patented in Germany.

(Abstract of a Paper read before the Elektrotechnischer Verein.)*

PERMANENT magnets are at present magnetised in various ways: sometimes, if the air gap in the magnet is comparatively large, they are placed across the poles of a powerful electromagnet; in other cases the magnets are slipped over a heavy copper conductor, the air gaps are bridged by iron, and a heavy current (obtained either from a large accumulator, or from a low-voltage homopolar dynamo) is passed through the copper; in both cases the provision of

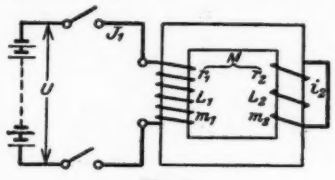


Fig. 1.

somewhat special apparatus is involved. A simplified method is embodied in a German patent taken out by Dr. Beckmann, by which the necessary heavy rush of current is obtained from a heavy copper conductor forming the secondary winding of a transformer which is magnetised or demagnetised momentarily by switching the primary on to or off from an ordinary d.c. supply source.

I. Magnetisation by Switching off the Primary.—When a transformer (fig. 1) provided with a primary in which a direct current is circulating and a short-circuited secondary has the supply suddenly switched off, the secondary current (neglecting the effect of the arcing of the switch) rises instantaneously to a high value and then falls off exponentially in accordance with the expression:—

$$i_2 = (M/L_2)\ J_1\ e^{-t/T_2}.$$

when i_2 = secondary current.

M = coefficient of mutual induction between primary and secondary.

L_2 = coefficient of self-induction of the secondary.

J_1 = the direct current initially in the primary $= U/r_1$, where U is the applied voltage and r_1 is the primary resistance.

t = time reckoned from the instant of switching off.

T_2 = time constant of the secondary $= L_2/r_2$, where r_2 is the ohmic resistance of the secondary.

The secondary current rises rapidly to the value $M/L_2\ J_1$, and then dies down more or less slowly in accordance with the value of the time constant. In order to magnetise a permanent magnet to the highest possible degree it is advisable not only to reach a high number of magnetising ampere-turns, but also to make these die down as slowly as possible so as to avoid objectionable eddy currents. As shown by the above expression, this is attained by making the magnetic coupling between primary and secondary as perfect as possible and by keeping the resistance of the secondary as low as possible so as to make its time constant high—the secondary should in fact be a single turn of heavy copper section, limited only by the dimensions of the permanent magnets which have to be looped over it. If the magnetic coupling between primary and secondary were perfect the initial rush of secondary current on switching off the primary would be larger than the primary current in the ratio of primary turns to secondary turns. Such high values are, however, never attainable in practice, because, not only has the secondary a certain amount of magnetic leakage of its own, but also every permanent magnet looped with it forms an additional external inductance. Besides reducing the value of the initial current, this added inductance also slows down the falling-off of the current by increasing the secondary time constant. Any arcing at the primary switch also reduces the initial secondary current and delays its falling off, but at the same time it limits the possible excess voltage rise at the primary terminals.

In order to check the above results by actual measurements an experimental magnetising apparatus was made up out of a 12-kVA, 3-phase transformer, as shown in fig. 2. Either of two different secondary flat copper rings could be used, the larger one having a section of 2.15 in. by .077 in., and the smaller one a section of .71 in. by .077 in. Various numbers (up to 12) of meter brake magnets having an air gap of 2 mm. were experimented upon.

The three-phase windings were only partly used, one being used as the primary, and having 132 turns and a resistance of .059 ohm, and another as an exploring winding. In order to get an oscillographic record of the secondary current a suitable fine-wire winding was added on the outer periphery of the secondary copper ring. The flux induced in the permanent magnets was also determined by means of a small exploring winding placed on one of the magnets and connected to

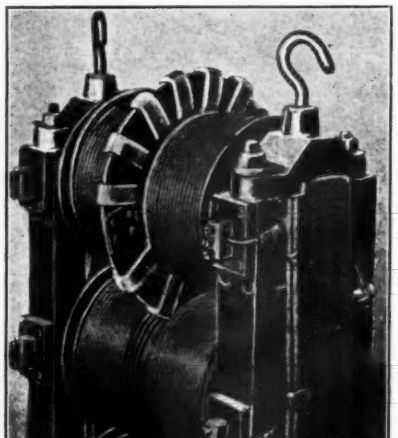


Fig. 2.

an oscillograph. If this winding has n turns its voltage $= n \times d\phi/dt \times 10^{-8}$, where ϕ is the flux in the magnet. By step-by-step integration of this voltage curve the curve of actual flux can be arrived at. Figs. 3 and 4 show the changes of primary and secondary current when no magnets were placed on the secondary, and a primary current of 30 amps. was suddenly broken by means of a double-pole switch. Fig. 3 refers to the larger section, and fig. 4 to the smaller section of secondary copper ring.

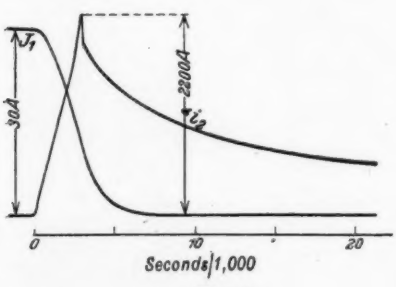


Fig. 3.

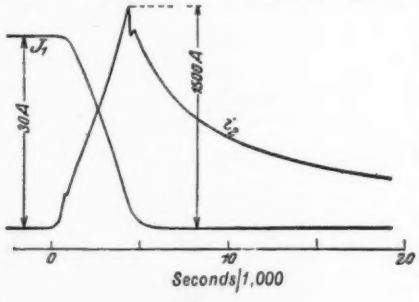


Fig. 4.

Fig. 5 shows the results obtained (with the larger ring) when 12 brake magnets were mounted in position for magnetisation. The curve marked $e\ \ddot{u}$ shows the voltage rise in the primary winding. In fig. 6 the results of fig. 5 have been evaluated. It will be seen that the permanent magnet only attains its maximum flux some time after the moment of maximum secondary current, owing to the effect of eddy currents set up in the solid steel. The flux then falls off a little to about 10,000 Maxwells, and this falls still further when the soft iron armature, used to close the air gaps of the magnets, is removed. The final flux density B in the air gaps of the magnets was found to average 1,100 gauss. During the many tests made, the magnets often had to be demagnetised, and for this purpose it was only necessary to switch the transformer primary on to an a.c. supply and to reduce this supply voltage gradually to zero. Also, each time

* By Dr. E. Schulze, from *E.T.Z.*, June 28th, 1928.

the d.c. supply had to be switched on to the primary (before taking a switching-off reading) this switching-on was done very gradually by means of resistance so as not to risk magnetising the magnets in the reverse direction. The attainable flux density is found to increase with the primary ampere turns used, and it can also be further increased by repeated switching off. Fig. 7 shows these results clearly, the four upper curves giving the results of one, two, three and four switchings off with 12 magnets in use, all fitted with iron short-circuiting pieces across the air gaps. The next curve shows the effect of leaving these iron short circuits off, and the bottom curve shows the effect of using the smaller section of copper secondary ring (with iron " short circuits " on).

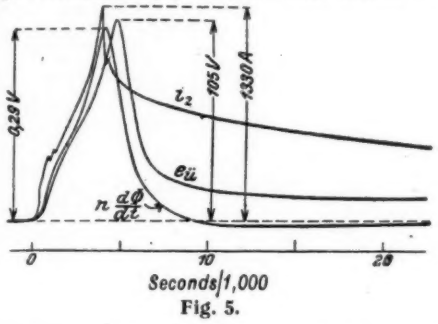


Fig. 5.

II. Magnetisation by Switching on the Primary.—Permanent magnets can also be magnetised quite satisfactorily by employing the rush of current set up in the secondary when the primary is switched *on* to a d.c. supply. In this case the secondary current is given by the expression :—

$$i_2 = -J_1 m_1/m_2 \,.\, T_2/(T_1+T_2) \,.\, \epsilon^{-t/(T_1+T_2)}$$

Where m_1 and m_2 are the primary and secondary turns, T_1 and T_2 are the primary and secondary time constants ($=L_1/r_1$ and L_2/r_2). In this case it will be seen that the rate of change of current is governed by the sum of the primary and secondary time constants. The rise of primary and secondary currents, with and without magnets and using the larger secondary copper ring, is shown in fig. 8. A primary voltage of 30 was used, and the final value of primary current was again limited to 30 amperes by inserting an external resistance (the voltage required by the primary winding itself being only 20×.039=1.8 volts). The use of such an external resistance is important as it reduces the primary time constant T_1. Fig. 9 shows how the residual magnetism (air-gap flux density) of the 12 magnets is increased by increasing the existing voltage (and external resistance) using the larger and the smaller secondary copper rings. It will be seen that little is gained by increasing the exciting voltage beyond 35 to 40 volts, *i.e.*, about twenty times the minimum voltage of 1.8.

III. Comparison of the two Methods.—Fig. 10 gives an interesting oscillographic comparison of the results of these switching *on* and switching *off* methods. When switching on to a supply voltage of 30, the flux in each permanent magnet reaches a maximum and then falls off a little (as the secondary current dies out) to a residual value of 14,400 Maxwells, and when the iron " short circuit " is removed this falls to a steady value corresponding to an air-gap flux density of 1,450 lines per sq. cm. This means that for the same value of primary exciting ampere-turns the switching *on* process gives considerably greater magnetising effect than the switching *off* process, in spite of the fact that the maximum value of secondary current is much smaller when switching *on* (825 amperes) than when switching off (1,330 amp.). This somewhat surprising result is due to the fact that when switching *on* the secondary current rises comparatively slowly to its maximum, and then falls off again slowly under the influence of the

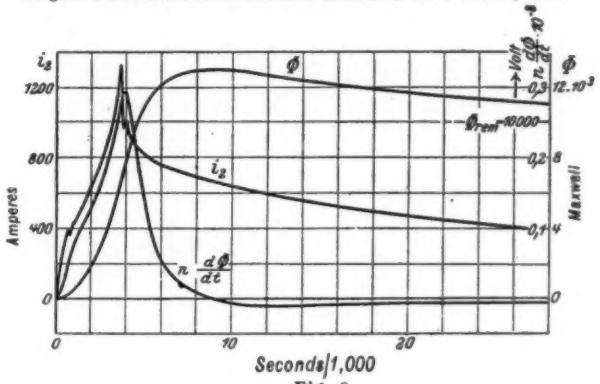


Fig. 6.

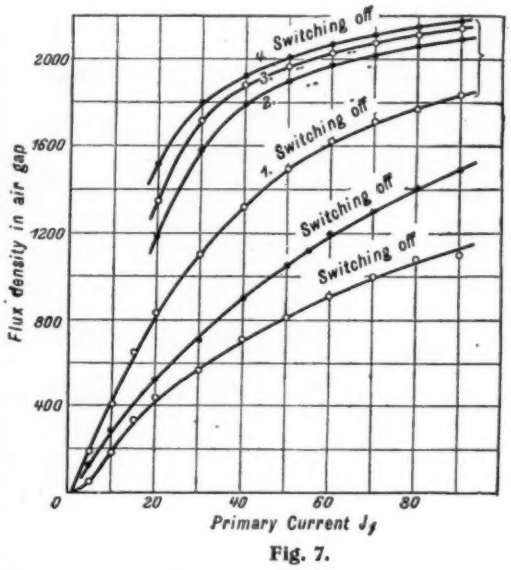
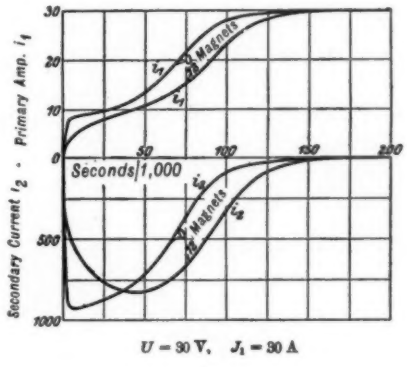


Fig. 7.



$U = 30$ V, $J_1 = 30$ A

Fig. 8.

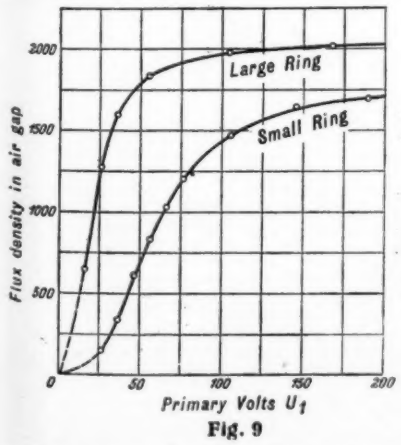


Fig. 9

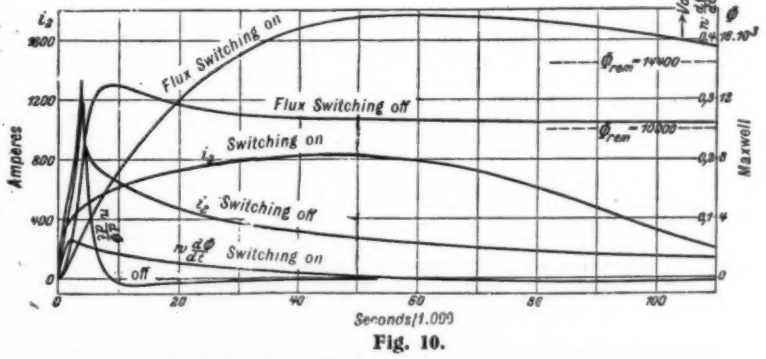


Fig. 10.

primary time constant, whilst when switching *off* the rise and fall are extremely rapid. The setting up of the flux in a permanent magnet is, in fact, not an instantaneous process, and does not depend only on the maximum ampere-turns reached. An appreciable time lag exists, largely due to eddy currents set up in the magnet steel, and possibly also to the time taken up by crystal movements within the material.

With the switching *on* process the direct current source of supply furnishes the magnetic energy, both of the transformer and of the permanent magnets at the same time, and, if desired, a second series of permanent magnets could be magnetised on switching off. In any case, the amount of energy taken from the mains is extremely small because of the short time that the process lasts, but this amount is distinctly greater with the switching *on* process than with the switching *off* process, because of the loss in the external resistance. On the other hand, as shown by the experiments, a smaller transformer can be used for the switching *on* process than for the other to obtain equal results.

The transformer employed in these tests was not particularly suitable for the work. It should have been provided with an air gap to ensure the disappearance of its flux each time the primary current was switched off. Also, the available space might have been better employed as regards volume of secondary copper. With a properly designed transformer, extraordinarily strong magnetisation can be produced in the magnets, and, if desired, this can then be slightly weakened by the application of an alternating current so as to ensure greater constancy (freedom from ageing).

The conclusion arrived at by the author is that, of the two processes, perhaps the better in practice is the switching *off*, as it involves less supply energy.

Electric Shunting Locomotives.

A brief description of two engines of unusual design that have recently been built by the Metropolitan-Vickers Electrical Co., Ltd., to meet the special requirements of quarry service.

BUILT for the Broken Hill Proprietary Co., Ltd., the two "Metrovick" electric shunting locomotives described below are to be used at a large iron-ore quarry, known as the Iron Knob Mine, New South Wales, Australia, for which a complete electrification scheme has been adopted.

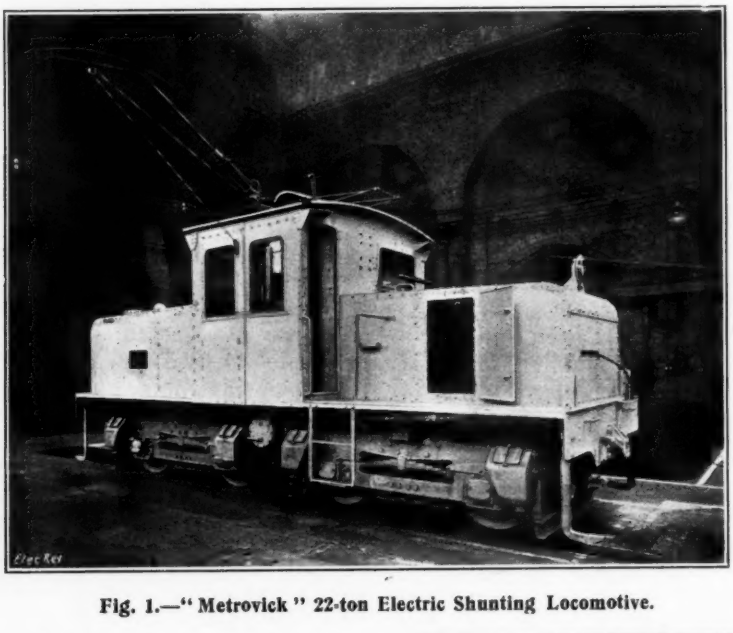


Fig. 1.—"Metrovick" 22-ton Electric Shunting Locomotive.

The two locomotives (fig. 1) are similar, each being capable of handling a shunting service of four wagons, each of 30 tons capacity, at from 5 to 10 miles an hour on the level and up a maximum gradient of 1 per cent.; each "rake" of wagons weighs about 200 tons when loaded and 80 tons when empty. The duty consists of taking a loaded rake from an electric shovel to the crusher about half a mile away, returning empty and reloading 1.1 times per hour, which allows 18 minutes for loading the rake, 20 minutes for travelling, and 16 minutes for dumping the ore. The track is of 3 ft. 6 in. gauge, and has a maximum curvature of 100 ft. radius.

The track and service are of the roughest nature, and for this reason the locomotives are of exceptionally robust construction; they are capable of being lifted in one piece for replacement on the track in case of derailment, and in service they will be specially protected by a heavy framework of timber over the ends of the body to prevent damage by a possible blow from the swinging shovel, or from the ore spilling from the shovel when loading.

The locomotives are of the swivelled double-bogie central-cab type, each bogie having two axle-mounted motors connected permanently in series for service at 600 volts, and the two pairs of motors are arranged for series-parallel control. Because of the prevalence of stone dust, the motors are totally enclosed, and all apparatus compartments are fitted with dust-proof doors. Fig. 2 illustrates one of the bogies, complete with motors, and shows the ruggedness of the construction. The control system is of a simplified electro-pneumatic type operated from a central driver's cab, one end of which is shown in fig. 3, the controls being duplicated in order to permit driving in either direction. A low-voltage supply for operating the control gear will be taken by means of a potentiometer from the 600-volt line.

For the air-braking equipment, manufactured by the Westinghouse Brake & Saxby Signal Co., Ltd., compressed air at 80 lb. per sq. in. pressure is obtained from a D.H.25 bungalow type compressor, which also feeds the reservoirs for the electro-pneumatic control system, pneumatic sanding, and the air whistle. Electricity is collected by means of a pantograph for ordinary service, supplemented by two sidebow collectors on tramway-type booms for use when the overhead line is widely displaced to clear the electric shovel. Fig. 1 shows the pantograph down and one side bow swung out for service. In addition, provision has been made for obtaining power by trailing cable when travelling on temporary extensions outside the area of the overhead-line equipment. The cable, 100 yd. in length, is carried on a motor-

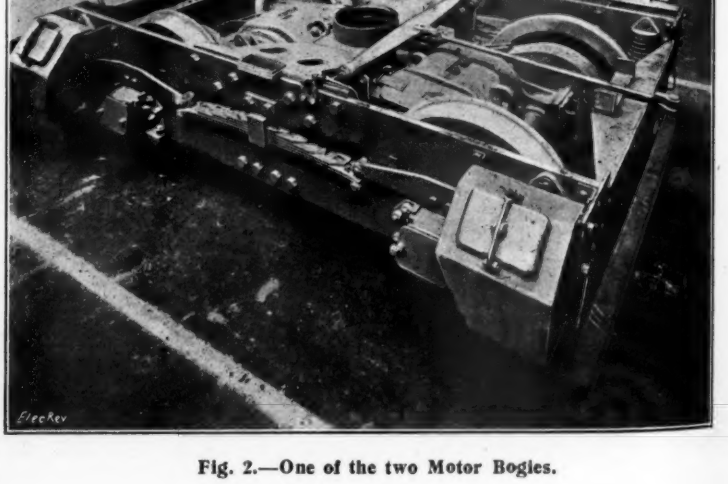


Fig. 2.—One of the two Motor Bogies.

operated reel mounted in a chamber at the end of the locomotive, and the end of the cable with its jumper can be seen in fig. 1.

The body of the locomotive has a total length of 23 ft. and an extreme width of 9 ft. It is divided into five compartments, *viz.*, the cable-reel and compressor compartments at one end, the driver's cab in the middle, and the control apparatus and resistance compartments at the other end. The cab is provided with drop windows to enable the driver to obtain a side view along the train and also to manipulate the control cords of the sidebow collectors without leaving the locomotive. The pantograph is raised and lowered by means of a winch in the cab. Each locomotive in working order weighs about

Fig. 3.—Part of the Driver's Cab, showing the Master Controller and the Hand-brake Pillar.

22 tons, and is capable of a continuous tractive effort of 1,100 lb. at 8 miles per hour; at the hourly rating the tractive effort is 3,500 lb. at 5 miles per hour.

Power for the operation of the electrical equipment of the quarry is brought by a 33,000-volt transmission line from the company's generating station at Whyalla. In a sub-station at the quarry the voltage is stepped down to 3,300 volts, and a motor-generator set provides the necessary 600-volt d.c. supply for the locomotives. The transformers and switchgear for the transmission system and the whole of the equipment for the sub-station have also been supplied by the Metropolitan-Vickers Electrical Co., Ltd.

The Congress of Radiology.

A brief account of the proceedings at the second international Congress of Radiology, which was held in Sweden last month.

An important gathering of X-ray workers from most parts of the world assembled at Stockholm, Sweden, for the second International Congress of Radiology (July 23rd to 27th). Some 1,500 medical practitioners, physicists, engineers, and instrument makers attended for the purpose of contributing to, or deriving instruction from, the discussions on the many aspects of radiological science; in all 223 papers were read by well-known X-ray workers. Accommodation was provided for the meetings at the Swedish House of Parliament.

To those not intimately concerned with X-ray work, the tremendous progress which this important science has made during the last few years is well-nigh incredible. Its growth and its extended applications have stimulated the evolution of a new branch of electrical engineering; its physical problems have embraced fields requiring attack by the most eminent electrical men; and the applications of X-rays to intra-atomic problems have opened up new avenues of research which many of the world's most eminent physicists are following up.

The most important aspect of the Stockholm Congress was, of course, the medical one. Meetings were held under four classifications: Röntgen diagnostics, Röntgen and radium therapy, radiobiology and heliotherapy, and radiophysics and medical electrology.

It is not only due to better X-ray apparatus—and here it may be mentioned that the induction coil is extinct and the h.t. transformer supreme—but also to considerable advances in photographic technique, that the radiologist can to-day diagnose not only broken bones and swallowed coins, but also such things as the earliest stages of tuberculosis and disorganisation of tissues, which a few years ago were regarded merely as "transparent" to the rays. To-day the radiological equipment of a hospital is considered to be amongst the first essentials, and immense sums of money are being spent in providing new hospitals with adequate X-ray apparatus.

A feature of the Congress was an exhibition of X-ray apparatus in the Art Galleries building, which was contributed to by the leading international firms. Considerable importance had been attached to the exhibit, for it was the first occasion on which it had been possible for British manufacturers to display their products on a large scale at such a congress outside Great Britain. Actually this special exhibition was, as a distinguished personage was overheard to say, "ninety-five per cent. German and five per cent. English and Swedish." None but an eye-witness could quite appreciate what a place has been taken by radiological equipment in the world's electrical engineering industry. A modern X-ray installation for a big hospital may easily cost £50,000, perhaps double that sum, and German engineers appear to be assuming the position *par excellence* of European manufacturers.

A brave attempt had, nevertheless, been made by British manufacturers in the way of a composite exhibit, in which the productions made excellent showing against those of foreign competitors.

One of the spectacular features of the Congress was its revelation of the progress that has been made in X-ray kinematography, and the invention described by Mr. A. Dauvillier was particularly interesting, embodying, as it does, some of the most recent principles of television. A radioscopic image on a fluorescent screen is telegraphically transmitted, by means of a common analysing disk with staggered apertures, to a viewing screen through the intermediary of a Kerr cell. By this process it is possible to watch the movements of the heart, or other organ, on a viewing screen and to make diagnostic studies at leisure; its value in medical teaching may be very great. The subject of X-ray kinematography was further discussed in a communication by Mr. B. E. Luboshey, of Paris.

An instrumental paper of importance was that of Dr. A. Bouwers, of Eindhoven, Holland, in which he introduced new X-ray apparatus that affords complete X-ray and electrical protection. It is an amplification of the Philips metal tube, and is provided with a ventilator-cooled anticathode, the motor of which is driven by energy derived from the electricity supply mains.

Proposals from the Swedish X-ray and Radium Protection Committee were carefully considered, and eventually it was decided to adopt, with one or two minor alterations, the proposals that had been put forward by the British Committee at the previous international Congress in London. Opportunity will be provided three years hence (in Paris) for the adoption of such further modifications as may in the meantime have proved themselves necessary.

A unit "r" was decided upon for the measurement of X-rays or radioactivity; quantities of X- or gamma-rays will henceforth be measured in electrostatic units, and not by an ionisation chamber of standard dimensions as had been suggested.

It is quite impossible in so short a report on the Congress to touch upon the many exceedingly valuable papers contributed by leading British and other roentgenologists. The mere immensity of the Congress—and this is no idle term—showed how completely this young science has become highly specialised, with a need for its own particular class of engineer and physicist. It may not be generally known that in this country there are post-graduate courses, examinations, and a special Diploma for Radiology, as well as a Society of Radiographers, and the British Institute of Radiology. It is almost certain that within the next few years special training will become necessary for those engaging in X-ray electrical engineering.

Model Engineers' Exhibition.

The tenth Model Engineers' Exhibition, which opens on September 15th, in the Royal Horticultural Hall, Westminster, London, promises to be the most interesting of the series. The novel attractions will include a mechanised orchestra, and a Robot—a mechanical man who rises and sits, talks to the visitors, and occasionally operates a machine tool. The Robot will make his first appearance in public when he makes a speech and officially declares the Exhibition open.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Novel Lamp Flasher.

The "Eagle Blinker," fig. 1, is a small lamp-flasher unit which has recently been introduced by the Eagle Electric Co., 151, Wardour Street, W. It consists of an ordinary bayonet lamp cap and the "sleeve" and plunger unit of a b.c. lampholder, with a small flasher in a suitable cylinder between. The whole unit measures 2.5 in. long. The actual flasher consists of a bi-metal contact unit shunted by a

Fig. 1.—Combined Lampholder and Flasher.

heating resistance coil, so arranged that expansion of the bi-metal contact makes the lamp circuit. The coil is then "short-circuited" and the contact-piece allowed to cool and break circuit. "The Blinker" may be used directly in conjunction with a single lamp or to control a number of lamps, advertising sign, and so on, providing, of course, the loading, 40-100 W, is not exceeded. The apparatus is made, at present, in metal, and is suitable for use at all standard voltages. A standard unit with a normal flashing period is provided, but faster or slower flashing can be supplied to order. It is claimed that the unit is not subject to deterioration due to atmospheric changes.

A New Miner's Lamp and Detector.

Although electric safety lamps are gradually displacing oil lamps for illumination in coal mines, a number of the latter

Fig. 2.—Combined Lamp and Gas Detector.

are still carried for the detection of firedamp, even where the whole of the lighting is done by electric safety lamps, with the result that the deputy, when examining the workings, has to carry two lamps. A novel lamp which has been approved by the Mines Department for use underground and introduced recently by Messrs. Ceag, Ltd., Barnsley, Yorks., is designed to overcome this difficulty. It consists of a small oil lamp combined with an ordinary mining lamp, and provides means whereby the flame can be lit by a platinum wire heated by the current from the lighting battery of the lamp. The oil vessel is carried above the electric bulb, and is protected by double gauzes in the usual manner. When a gas test is made the electric light is switched off and the oil flame (by means of the platinum wire) on, suitable switches being provided. When an explosive mixture of gas (methane) is present, a cap is formed by the gas burning over the low oil flame, and from the height of this cap an experienced observer can estimate the amount of gas present. As the test is made in total darkness and steps taken to prevent reflection, the cap, which is of an ethereal nature, is not hard to distinguish. Fig. 2 shows a bull's-eye type of lamp with the Ceag detector fitted.

High-Lamp-Suspension Equipment.

The accompanying illustration, fig. 3, shows a novel application of lamp-suspension equipment recently introduced by The London Electric Firm, Brighton Road, South Croydon. The problem was to fix a lamp above the top of a wireless mast as a warning light to aviators of the existence of the structure, and to provide means of lowering the lantern to the ground for cleaning and maintenance purposes. The

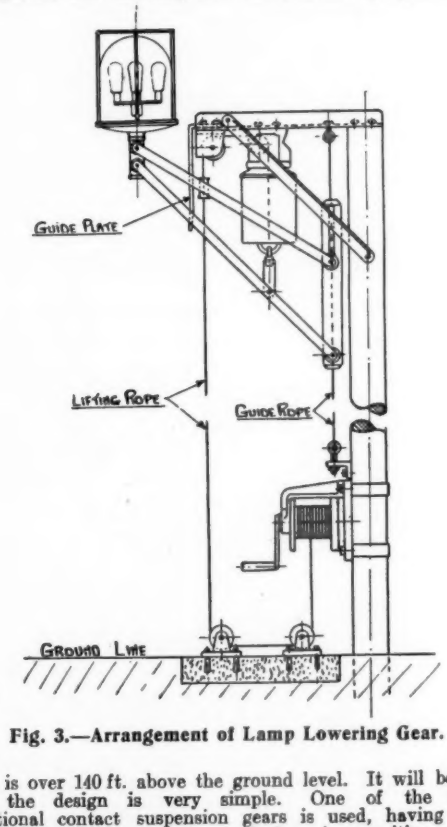


Fig. 3.—Arrangement of Lamp Lowering Gear.

lamp is over 140 ft. above the ground level. It will be seen that the design is very simple. One of the firm's directional contact suspension gears is used, having knife contacts of a substantial size, and there is a positive weight-relieving device which transfers the weight of the fitting to the fixed gear when in its normal working position, so that the wire rope only comes into action during the process of raising and lowering. The lowering rope also acts as a guide. One of the firm's large-size standard winches with the usual self-sustaining motion is used for operating the gear. The work has been carried out for and in collaboration with Messrs. Siemens Bros. & Co., Ltd., for use with their tubular steel masts supplied for a Colonial Government wireless station.

Tramways and Light Railways Association.

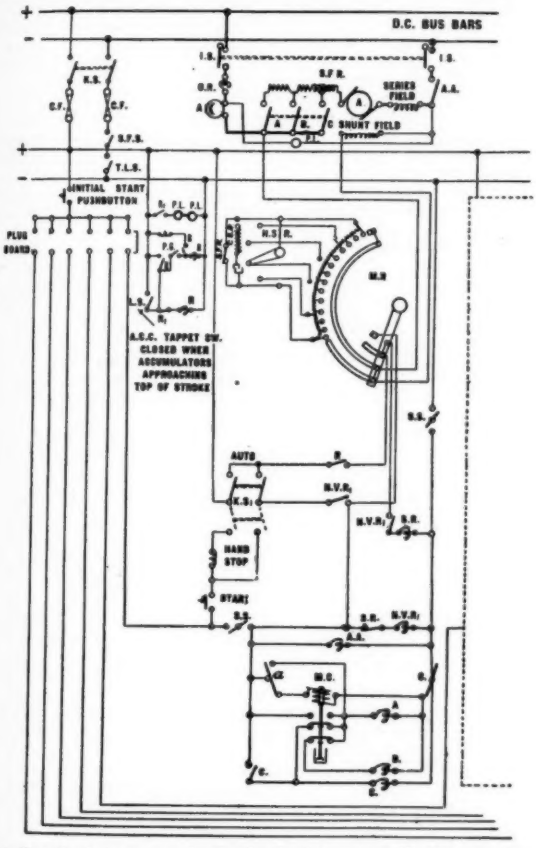
The annual dinner and smoking concert of the Tramways and Light Railways Association will be held at the Hotel Cecil on Friday, October 26th, 1928. The chair will be taken by the Hon. Sir Arthur Stanley, president of the Association.

Electrically-Controlled Pumps.

Some details of the Electric Control Gear for a Hydraulic Pumping Station at Tilbury Docks.

HYDRAULIC pumping plant is being installed for the Port of London Authority at Tilbury Docks on the River Thames, consisting of three 150-h.p. and three 45-h.p. accumulator pumps, two accumulators, and two feed pumps to the elevated suction tanks for the accumulator pumps. The accumulator pumps are all to be controlled from the height of the two accumulators, and the driving motors are being fitted with speed-variation gear, while the feed pumps will be stopped and started by floats in the suction tanks.

The control units consist substantially of six separately mounted controllers (each of which starts and stops one particular pump), together with a master controller operated



A.A., Line Contactor; A.B.C., Accelerating Contactors; M.C., Master Controller; N.V.R., No-Volt Relay; S.R., Stopping Relay; F.S., Float Switch; C.M.S., Contactor Magnet Starter; O.R., Overload Relay; M.R., Master Regulator; H.S.R., Hand Shunt Regulator; S.F.R., Shunt Field Protective Relay; F.S.I., Float Switch Isolator; R., Interlocking Relay; I.S., Isolating Switch; P.L., Pilot Lamp; K.S., Knife Switch; S.S., Snap Switch (D.P.); R_1, Alarm Relay; S.F.S. Safety Float Switch; T.L.S., Top Limit Switch; C.S.R., Condenser Series Resistance; E.R., Economy Resistance; A.S., Switch for Alarm Signal; P.G., Pressure Gauge with contacts for shutting down plant if hydraulic main bursts.

Pump Controller No. 1—45 H.P.

by the rise and fall of one, or both, accumulators through the medium of chain mechanism. The control system is arranged so that any set can be hand-operated if desired, and taken off the automatic circuit. The master controller consists of six regulators of the face-plate type, the arms of which are actuated by a common spindle which is rotated in accordance with the fluctuations of the accumulators. The regulators may be set by hand, when plant is standing, at various definite relative angles, so that they will function in accordance with any desired sequence. Each regulator has contacts for initiating the starting of the corresponding pump-motor controller, and for regulating its speed up to the maximum determined by the setting of its hand-actuated shunt regulator. Thus, as the accumulators fall each pump will in succession be started according to the sequence and accelerated to the maximum pre-determined speed before the next pump in order is started. As the accumulators rise the pumps will be slowed down and finally stopped in the reverse order to that in which they started. This method not only controls the running of the pump, but also the delivery, and thus can keep a set running continuously instead of its being repeatedly cut in and out of operation by the accumulator rise and fall. Assuming the accumulators are at the bottom of the stroke and the whole plant is at a standstill, the following is the sequence of operation in order to start the whole equipment, the first operation being to close the delivery valve on the accumulator main:—The feed-water pumps are set in operation and, assuming there is no water in the tank, the float switches close and complete the control circuit of a double-pole line-contactor and contactor magnet starter, with the starter resistance in series; but, on the closing of the contactor magnet starter, normal running is obtained and the feed pump motor is then subject to the float control of the tanks. Then the accumulator pump system is brought into operation by starting the first set of pumps (No. 1) so as to raise the accumulator to the top of the stroke. This is done by placing the single plug in the plug board corresponding to the first pump of the sequence, and an initial start push-button is pressed until all the starting circuit sequence of operations is complete, when the button can be released.

The master controller now controls the closing of contactors in succession, which cut out the starting resistances and accelerate the motor to one-third its full speed. The motor is run up to this point with full field excitation, but, when the final contactor is closed, the shunt-field relay causes the motor to accelerate until the maximum pre-determined speed is attained. The first pump causes the accumulators to rise, and in so doing the chain mechanism drives the regulators round to their starting positions one after the other, the other pumps not yet being in operation. As the accumulators approach the top of their stroke the speed of the first pump is gradually reduced by the reverse action of its master regulator until, through a limit switch, relay, and interlock, the stopping relay operates and shuts down the pump. Then, when the accumulators are full, all the plugs are inserted in the board and the full number of pumps function as required.

When the valve on the delivery side of the accumulators has been opened and water used, the accumulators fall and drive the master regulators through the chain mechanism. Each pump is thus started and accelerated to its maximum predetermined speed before the next one in the sequence is started; the further the accumulators fall, the more pumps are started. A top-limit switch is provided which will trip out the complete set of pressure pumps should the accumulators over-run the limit of their normal travel, and there is also a main control knife-switch which renders all control circuits dead.

On the occurrence of a burst pipe an electrically-connected pressure gauge on the delivery side of the accumulators will close its contacts due to fall of pressure, and thus energise a relay which, on closing, trips out another relay and displays a red alarm signal; this second relay, in turn, shuts down all the pressure pumps. Any pump may, however, be re-started immediately by push-button should it be necessary to do so to locate the fault. One of the six main panels is shown diagrammatically herewith, so that the description can be followed clearly.

The pumps were made by Messrs. Fullerton, Hodgart and Barclay, Ltd., Paisley, and the electric switchgear by the Electric Control Co., Ltd., Glasgow.

Correspondence.

***Correspondents should forward their communications as early as possible.** No letter can be published unless we have the writer's name and address in our possession.*

Does it Pay to Acquire Knowledge?

The ELECTRICAL REVIEW is to be congratulated on the lead it gives to the industry. In your issue of July 20th you comment on the need for the right man to develop electricity in rural areas, and in that of July 27th you practically ask for the right man to be encouraged in research work. The present method of filling vacancies seems to be: if a man is very keen to do the job, don't give it to him. A man who shows himself keen is between two fires: (1) The jealous manifestations of his fellow-employés—this is a part of the game, and adds to the enjoyment, but when you consider (2) that his employer looks on him as a nuisance for several reasons, it is time to sit up and take notice.

I wonder if engineers realise that the false saying: "A skilled man promoted is a skilled man lost" now applies to them, since engineering posts are now skilled rather than administrative posts. When will employers realise that a skilled man hands on his skill (whether it is "technical" or "practical") to many when he is in a position to do so without injuring himself?

Now, I have made myself skilled to develop electricity, especially in rural areas, yet after missing six such berths on petty grounds after short-leet interviews—such as too keen—too old—handwriting like a schoolboy's, and so on—I have found that the most important qualification (it seems) is that you must have had 10 years as a mains engineer. Of

course, your article did some good; the next week one man aged 22 was required for rural development.

"Ambitious" has only just begun to find out some of the laws which govern promotion. Suppose I did write as I feel on this subject: "I see before me a country rising; without slums; with power removing the burden of toil—the same power which can work for the miner in the pit can keep the food warm for the infant in the cot on the hillside, and so give the mother longer hours of rest." I can almost hear the shout across the office: "Look at this comic one."

Courage, knowledge, and vision are not required in the electrical industry: a certain suavity of manner, good luck, and knowing the right man are more important. There are not any £5,000 a year men chiefly because the men who can carry the major posts cannot get a sympathetic trial in the minor posts. No, "Ambitious," spend your money at the nearest place of refreshment or sport, and you will be able then to impress the men who have the power to recommend you for promotion. This may be light reading to some, but it is serious for us who will not always remain—

Aged 36.

August 11th, 1928.

Referring to the query: "Does it pay to acquire knowledge?" may I be allowed to question the accuracy of the figures given? "Ambitious" states that, in order to obtain the degree of B.Sc. (Eng.) by July, 1929, he will have to put in *not less than* 90 *hours*' work every week between now and then.

Ignoring overtime, few engineers' offices work less than 40 hours per week; allowing 28 hours for meals, we must deduct from the total of 168 available hours these 68 hours, leaving 100 hours. Few men could carry on for nearly one year without, at the very least, four hours' sleep per day; allowing for dressing and undressing, &c., we must deduct another 30 hours from the 100 hours available, leaving, as a *generous* estimate, only 70 clear hours available for study. Does "Ambitious" extend his hours of study into office hours? If so, this may account for the low salary of £223 per annum for a man of 32, and A.M.I.E.E. to boot.

Not only so, but any man studying so intensively for such a long period must, necessarily, be quite unfit each day and every day for a full day's work.

At 32 years of age "Ambitious" should know that promotion will undoubtedly be slow if he pays such scanty attention to his work. Let him study by all means, but in moderation, and certainly not more than 25 hours per week as a maximum. Also, let him study something more practical and useful than the B.Sc. (Eng.) subjects.

I certainly agree that the benefits of a degree are not worth the sacrifices he will have to make. His most pressing need is to increase his salary, and soon. The £6 monthly for tuition will be more easily found two or three years hence, after he has established himself in another job.

My advice would be to get out of his present job into a better-paid one. Having gone thus far, let him give up the idea of studying for a degree at present, and devote all this superfluous energy to studying his job alone. At the end of a year, if not before, he will find the promotion he craves, with a gratifying increase in salary.

But let him beware of his ambitious instinct—there are other things in life besides work.

P. Shearer.

Rugby, *August 19th*, 1928.

[Surely "Ambitious" included his office hours in the 90 hours' work he mentioned; hence the figure is quite possible—but by no means expedient.—Eds. Elec. Rev.]

A Telegraph Merger?

In reference to the "Telegraph and Telephone Notes" in your issue of August 17th, I think your information must be at fault and that the arrangement you refer to as having been made between the International Telegraph and Telephone Co. and the Western Union Telegraph Co. must refer to the statement made by Mr. Gifford, the president of the American Telephone and Telegraph Company, on August 9th, which is as follows:—

"The American Telephone and Telegraph Company has completed arrangements with the Western Union Telegraph Company that should further the development of electrical communications. In order to provide the best possible telephone service at the least cost, the American Telephone and Telegraph Company carries on continuous research and development and, as is well known, maintains a nation-wide network of telephone toll and long-distance lines. Some of the developments of its Bell Telephone Laboratories have been incorporated in ocean telegraph cables, resulting in a large increase in capacity of words transmitted. Other developments and inventions of the laboratories can be utilised on telegraph lines and enable additional circuits required by telegraph companies to be superimposed on telephone toll and long-distance lines. With the view of placing these developments at the service of the public, the American Telephone and Telegraph Company decided to make them available to telegraph companies, and offered a series of non-exclusive contracts to the Western Union Telegraph Company, which have now been executed. Among them is one for the use of plant which should ultimately result in eliminating to a large extent the present duplication of parallel pole lines and wire circuits, since, by the use of proper apparatus, it is possible to telephone and telegraph simultaneously over telephone toll and long-distance wires. By this new arrangement many of the advantages that would accrue from the consolidation of all electrical communications will be obtained, and at the same time the complete independence of the telephone and telegraph companies will be maintained.

"A contract has also been entered into by which the Western Union Telegraph Company may lease the apparatus developed in the Bell Telephone Laboratories so that under certain conditions several telegraph channels may be obtained from a single pair of telegraph wires.

"A further contract provides that the Telephone Company's telephoto system will be available to the Western Union Telegraph Company's patrons for handling facsimile message service between the cities where the Telephone Company operates its system of sending pictures by wire."

S. J. Goddard,
Vice-President,
Western Union Telegraph Company.

London, *August 20th*, 1928.

Shoddy Wiring.

"A Reader's" letter in your issue of August 17th regarding shoddy wiring is very interesting, and his remarks regarding authorised persons only being allowed to carry out electrical installation work outline the happy state of affairs which all *bona-fide* electrical contractors are hoping for. It appears though, from the following, that we shall never see this come to pass.

In this town a firm of plumbers applied for registration on the N.R.E.I.C. This firm had never employed any electrical staff, and any wiring work which came its way was carried out by one of the partners, a son, who also did most of the plumbing, gas fitting, &c.

After protesting to the secretary of the National Register regarding this application, we were told that the partner mentioned above had entered himself on the application form as "Qualifying Manager," and that the local Advisory Committee had approved the application.

We wrote again to the secretary and asked who the local Advisory Committee consisted of, and were informed that this consisted of a representative of the Institution of Electrical Engineers, and the borough engineer, and that the Electrical Contractors' Association representation was still in abeyance.

We were also informed by the secretary that our letters were impertinent.

The views of other members of the N.R.E.I.C. who have known similar instances would be much appreciated.

N.R.E.I.C.

August 18th, 1928.

Radio Valve-anode Capacitive Resistance.

I would like to thank Mr. J. H. Owen Harries for his very sincere criticism of my article on the above subject, especially as it enables me to elucidate certain portions which have been perhaps a little obscure.

References to arguments concerning figs. 1 and 2 in my article are, I think, sufficient to show that I agree with Mr. Owen Harries's use of vector analysis as regards his fig. 1, even when the d.c. component is present, and since he has not objected to the remainder of the arguments concerning my figs. 3, 4, 5, and 6, I will take the liberty of assuming that he agrees with them.

His main objection seems to be that I have treated a valve as a variable resistance. The most stable and most important characteristic of a valve is its mutual-conductance (*i.e.*, the slope of the static plate current/grid volt curve), and since this is the reciprocal of the mutual impedance, I think I am entitled to my assumption.

Mr. Owen Harries treats the fact of the changing potential across the anode-cathode of the valve as having primary connection with the change in volts applied to the grid, whereas actually this change is only a secondary, due to the change in resistance (or impedance) of the valve permitting more, or less, current to flow through any external resistance with which it is in circuit, such changes in current producing corresponding changes in potential across the external resistance, which, by Kirchhoff's law, must add to or subtract from, the applied potential, thus producing a reverse change in potential across the anode-cathode of the valve. This is proved by the fact that if there is absolutely no external resistance in series with the anode-cathode and the source of supply, then although a change in volts applied to the grid will produce a change in current flowing in the circuit, no change of potential will, or can, exist across the anode-cathode.

If I have now convinced Mr. Owen Harries on these points, may I hope that he will re-read the article paying especial attention to my definition of the term "alternating current" as opposed to fluctuating direct current, as upon this is based the entire structure of my argument.

Ernest W. Braendle.

Blackheath, *August 18th*, 1928.

In reference to my letter of the 11th inst., which you have kindly published in your current issue, I notice a clerical error in the first two equations, due, presumably, to the very short time which was at my disposal to write the letter.

The condenser susceptance is, of course, negative, and not positive, as accidentally given, *i.e.*, it equals $-jc2\pi f$, and not $+jc2\pi f$, as shown.

J. H. Owen Harries.

Frinton-on-Sea, *August 18th*, 1928.

Referring to Mr. Ernest W. Braendle's most interesting article in last week's issue of your paper, entitled "Radio Valve-anode Capacitive Resistance," and to Mr. J. H. Owen Harries's letter in this week's issue, I would crave your indulgence for a little space in your columns for a few comments on the subject. My only excuse for this little outburst is that the subject is one in which I have been interested in for some time past. Mr. Harries, in his reply, refers to Mr. Braendle's "false assumption that the slope resistance of the valve is varied by its grid potential," but this is obviously an assumption of Mr. Harries's, for Mr. Braendle makes no mention of "slope resistance" in his article, it being fairly clear that the resistance referred to by Mr. Braendle is the d.c. resistance, which depends on the grid bias volts.

It seems the practice nowadays to treat the valve as fundamentally a generator of fixed internal resistance, and if a new method suggested does not fit in with these so-called fundamentals, the method is considered incorrect.

Actually the only fundamental fact we know regarding a three-electrode valve is that the plate current is dependent on the potential of the grid relative to the filament.

Neglecting phase shifts in the valve, it is scarcely an assumption to consider the resistance of the valve as being dependent on grid volts. This would be very simple but for the fact that the plate current also depends on the anode voltage, which is a variable. This means that the valve resistance is dependent on both grid volts and anode volts.

If the amplification of a valve and its output circuit is calculated, using the above method of reasoning, it will be found to depend on the h.t. voltage, which is borne out in practice, for the increase in output due to raising the h.t. volts is very apparent in the average set.

Treating the valve as a generator, however, we get the result that the amplification is entirely independent of the anode voltage.

μ, the amplification factor, and R_2, the so-called slope resistance, are arbitrary quantities derived from valve curves, and have applications in certain cases, but must not be applied indiscriminately to a problem. This is demonstrated in the recent articles on the pentode valve in a wireless journal, for the slope resistance of this valve is round about 30,000 ohms, and for satisfactory working is "matched" by an output impedance consisting of a moving coil of approximately 2,000 ohms; how does this compare with the generator system of matching of equal impedances for maximum power output?

The only fundamental quantities we have in a valve are the terms mutual conductance and d.c. resistance at some specified anode volts.

I hope Mr. Braendle will find it possible in the near future to give us some formulæ relating to this matter, and I also trust any others interested will contribute their comments on this most fascinating subject.

A. H. Johnson.

London, *August 17th*, 1928.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1926.

19,235. "Duplex telegraphy." W. S. Smith and N. W. McLachlan. May 2nd, 1927. (294,269.)

1927.

2,055. "Treatment of hydrocarbons with electric arcs." J. Y. Johnson (I. G. Farbenindustrie Akt.-Ges.). January 24th, 1927. (294,494.)

4,121. "Electromagnetic regulating apparatus or governors." E. Kieback and P. Peter. February 14th, 1927. (294,505.)

4,726. "Control of electric motors." British Thomson-Houston Co., Ltd., and R. D. Given. February 19th, 1927. (294,495.)

5,174. "Introduction of chemically-active metals into evacuated or gas-filled containers." Westinghouse Lamp Co. March 20th, 1926. (267,902.)

7,757. "Electrical control devices." British Thomson-Houston Co., Ltd., and W. J. Pool. March 21st, 1927. (294,497.)

7,824. "Polyphase electrical condensers." Dubilier Condenser Co. (1925), Ltd. March 19th, 1926. (267,982.)

7,825. "Polyphase electrical condensers." Dubilier Condenser Co. (1925), Ltd. March 19th, 1926. (Addition to 267,982.) (267,983.)

8,366. "Means for the inter-conversion of mechanical and electrical oscillations." R. D. Parry. March 25th, 1927. (294,556.)

8,656. "Magnetos." H. C. Mills. March 29th, 1927. (294,674.)

10,822. "Apparatus for producing ultra-violet light." F. W. Read and E. E. T. Greville. April 20th, 1927. (294,509.)

10,847. "Protection of electric line sections on fault." Siemens & Halske Akt.-Ges. April 24th, 1926. (269,924.)

10,956. "Quartz resonators." E. Giebe and Dr. A. Scheibe. April 24th, 1926. (269,935.)

11,069. "Alarm circuit systems, particularly fire-alarm signalling systems." G. C. Snyders, C. Gordyn, Jun., J. Van De Kamp, and C. E. A. Maitland. April 26th, 1926. (269,941.)

11,067. "Electric circuit-breakers or switches." A. Reyrolle & Co., Ltd., and F. Coates. April 25th, 1927. (294,517.)

11,082. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. H. Paulett, and T. P. Preist. April 25th, 1927. (294,519.)

11,195. "Metal-containing electric resistances and method of production thereof." Dr. M. Hauser. April 28th, 1926. (270,301.)

11,209. "Electric systems comprising an asynchronous machine cascaded with a commutator machine." Siemens Schuckertwerke Ges. (in liquidation). May 15th, 1926. (271,061.)

11,260. "Braking of rail vehicles." A. W. Maley and E. M. Taunton. April 27th, 1927. (Cognate application, 5,867/28.) (294,593.)

11,332. "Electric switches or relays." General Electric Co., Ltd., H. W. B. Gardiner, and M. H. Hunt. April 28th, 1927. (294,682.)

11,377. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and L. M. Simpson. April 28th, 1927. (294,686.)

11,443. "Plug-and-socket connectors for electric circuits, switches, fuses, and the like." C. L. Arnold and "M.K." Electric, Ltd. April 29th, 1927. (Cognate application 469/28.) (294,689.)

11,520. "Telephone systems." Associated Telephone and Telegraph Co. June 14th, 1926. (272,461.)

11,583. "Telegraphic relays, recorders, and the like instruments." J. A. Smale. April 30th, 1927. (294,698.)

11,611. "Current-rectifying apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. August 26th, 1926. (276,622.)

12,083. "Regulation of alternating-current dynamo-electric machines." International General Electric Co., Inc. May 5th, 1926. (270,737.)

12,127. "Double-current cable code telegraphy." H. V. Higgitt and Eastern Telegraph Co., Ltd. May 5th, 1927. (294,715.)

12,396. "Method of influencing a beam of light for use in connection with telephotography or television." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). May 9th, 1927. (294,719.)

13,325. "Electrical fuse." A. Henderson and H. P. H. Anderson. May 18th, 1927. (294,730.)

15,477. "Apparatus for lighting miners' safety lamps." E. A. Hailwood. June 10th, 1927. (294,742.)

15,811. "Electric cables." St. Helen's Cable and Rubber Co., Ltd., and H. Evans. June 14th, 1927. (294,744.)

16,360. "Wireless apparatus." S. A. Lamplugh, Ltd., and W. F. Winkles. June 20th, 1927 (294,747.)

17,850. "Switches for electric ignition apparatus." British Thomson-Houston Co., Ltd., C. J. Morton, and L. Griffiths. July 5th, 1927. (294,761.)

19,025. "Electric coupling." A. F. Bulgin. July 18th, 1927. (Addition to 273,490.) (294,765.)

22,048. "Mercury-vapour rectifiers and like apparatus." General Electric Co., Ltd., and E. Weintraub. August 20th, 1926. (Patent of addition not granted.) (276,366.)

22,143. "Devices for connecting armoured electric cables to junction boxes or the like." A. Hepburn. August 23rd, 1927. (294,784.)

22,327. "Manufacture of unipolar high-tension electric cables." C.E.A.T. Conduttori Elettrici ed Affini-Torino. June 3rd, 1927. (291,416.)

22,474. "Electrical cables." E. S. Ali-Cohen. August 27th, 1926. (276,685.)

24,856. "Mercury-vapour apparatus." Hewittic Electric Co., Ltd. September 21st, 1926. (277,972.)

28,325. "Flexible insulating material." British Thomson-Houston Co., Ltd. November 8th, 1926. (280,189.)

30,065. "Brush holders for dynamo-electric machines." L. Schunk and H. Ebe (trading as Schunk & Ebe (firm of). November 20th, 1926. (281,258.)

31,357. "Electric wire couplings or **tag** terminals." D. G. Robinson. November 22nd, 1927. (294,817.)

31,550. "Impulse-senders for use in telephone systems." Associated Telephone and Telegraph Co. June 14th, 1926. (Divided application on 272,461.) (281,303.)

32,664. "Construction of the means for regulating the electrical properties of induction electricity meters." Landis & Gyr Soc. Anon. December 24th, 1926. (282,648.)

33,228. "Electric measuring instruments." G. F. Shotter, W. G. Smith, and Crompton-Parkinson, Ltd. December 8th, 1927. (Addition to 290,738.) (294,831.)

33,253. "Electrical measuring instruments." Electrofio Meters Co., Ltd. (G Grisdale and E. Schneider). December 8th, 1927. (294,832.)

33,482. "High-tension volt meter." Dr. H. Starke and R. Schroeder. December 11th, 1926. (282,094.)

34,122. "Quick release of electric switches." Siemens-Schuckertwerke Akt.-Ges. December 24th, 1926. (282,669.)

34,453. "Furnace electrodes." Soc. Electro-Métallurgique de Montricher. October 13th, 1927. (Addition to 282,672.) (294,837.)

34,940. "Oil-immersed electrical circuit interrupters." Metropolitan-Vickers Electrical Co., Ltd. December 27th, 1926. (282,777.)

1928.

1,369. "Street-illuminating apparatus." C. Zeiss (firm of). January 29th, 1927 (284,321.)

2,206. "Terminals of electricity meters." Landis & Gyr Soc. Anon. February 21st, 1927. (285,806.)

3,886. "High-vacuum switches." Siemens-Schuckertwerke Akt.-Ges. March 26th, 1927. (287,843.)

4,130. "Brush holders for dynamo-electric machines." International General Electric Co., Inc. February 9th, 1927. (285,043.)

6,845. "Manufacture of electric incandescent lamps." General Electric Co., Ltd. March 10th, 1927. (286,718.)

8,097. "Method of, and means for, acoustic marine-sounding." P. A. D. Martl. March 19th, 1927. (287,456.)

13,056. "Manufacture of electric incandescent lamps." General Electric Co., Ltd. May 3rd, 1927. (Addition to 283,890.) (289,839.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 15th :—

Barcold Automatic Electric Refrigeration (lettering and design). No. 491,205. Class 6. Refrigerating machines.—The British Automatic Refrigerating Co., Ltd., 62, Victoria Street, Westminster, S.W.1.

Fidelus. No. 491,511. Class 8 Electric batteries (not for medical purposes). —A. S. McHugh & Co., 59, Side, Newcastle-on-Tyne.

Kinevox. No. 492,529. Class 8. Loud-speaking telephones and instruments and apparatus for the amplification of sound.—The Marconiphone Co., Ltd., Marconi House, Strand, W.C.2.

Grawor. No. 491,888. Class 8. Apparatus for use in wireless telegraphy and telephony.—Walter Volmann, trading as Grass & Worff, 18, Markgrafenstrasse, Berlin, S.W.68. (British representatives: Herbert Haddan & Co., 31, Bedford Street, Strand, W.C.2.)

Ethoplug. No. 492,395. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony.—Burndept Wireless, Ltd., Aerial Works, Grotes Place, Blackheath, S.E.3.

Ethowire. No. 492,394. Class 40. Electric wire covered with india-rubber. —Burndept Wireless, Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ACCRINGTON.—Housing scheme (49), Willows Lane Estate; H. Sanderson, borough engineer, Town Hall.

AMBLECOTHE.—Re-erection of works, for John Guest and Sons' Successors.

ARNOLD.—Elementary school, Arno Vale Estate; Notts Education Committee.

ASHTON-UNDER-LYNE.—Housing scheme (130), for the T.C.; J. Rowbottom, borough surveyor (returnable deposit of £2 2s.).

BARNSLEY.—Garages and house, Stairfoot; Barnsley Co-operative Society. Buildings on site of Corn Exchange; borough engineer.

BIRKENHEAD.—Central school, Conway Street; Education Committee. Extensions, British Legion Club, Park Road East; Rees & Holt.

BOLTON.—41 houses. Sharples Avenue; A. H. Price.

BOSTON.—Houses (28). with electric light work, for the T.C.; J. & H. H. Vamplew, builders.

BRADFORD.—Wesleyan Reform Union Church, Low Moor; trustees.

BRIDPORT.—Infantry headquarters, for Dorset Territorial Army Association; F. T. Maltby, architect, Dorchester.

BROMBOROUGH.—Reconstruction of Pool Bridge; Mouchell and Partners, Ltd., London, engineers.

COLCHESTER.—Housing scheme, Defoe Crescent; borough engineer.

COULSDON.—Destructor works, Kenley (£29,000); U.D.C. surveyor.

CRAWLEY.—Re-erection (after fire), of the Imperial Picture Palace, for C. Gadsdon (£7,000).

DARLINGTON.—Mission hall, shops and houses; J. E. Chilton, architect.

DEWSBURY.—Casual wards, Staincliffe Institution, with electrical and heating work, for the B.G.; W. Hanstock and Son, architects, Branch Road, Batley (September 11th). Extension of Mitchell Laithes sewage disposal works (deposit £2 2s.); J. Diggle & Son, engineers, Hind Hill Street, Heywood.

DUNS.—Reconstruction of business premises, for the Co-operative Society; secretary.

EASTBOURNE.—20 houses, Downs Avenue; J. Bodle, Ltd.

EASTWOOD.—School; Notts Education Committee.

ECCLES.—Electricity sub-station, Monton Road (deposit £2 2s.—last date September 1st, 1928); borough engineer, Town Hall.

ECCLESHALL.—Conversion of Standon Hall into centre for orthopædic treatment, for Staffs. C.C.; clerk, Stafford.

FARNHAM.—Alterations, Mary Yolland Home, Hale; Messrs. Caesar Bros.

GALASHIELS.—Re-erection (after fire) of factory for Laidlow and Fairgrieve, Ltd., woollen yarn spinners.

GRAVESEND.—Re-erection after fire of premises for W. R. Barton & Son, Cumberland Works, Milton Road. Houses for the T.C.; S. & G. Bridger, Wrotham Road (48), and V. G. Dean, Mid Higham (104), builders.

HULL.—Laboratories, Alfred Gelder Street (£7,250); city architect. Extensions, East Destructor Works (£26,500); city engineer. New pier and landing stage, L.N.E.R. and Corporation.

HYDE.—Council school, Greenfield (deposit £3 3s., last date September 8th, 1928); S. Ashworth, secretary for education, Education Offices.

KENDAL.—Additional 200 houses, for the T.C.; borough surveyor.

KIMBERLEY.—School; Notts. Education Committee.

KINNITTY, BIRR.—National school; Rev. P. J. Hogan, P.P., Parochial House.

LANARKSHIRE.—Church and vestry at Cartcosh; clerk of Presbytery, Hamilton.

LINCOLN.—Additional 100 houses and also 50 (by direct labour), for the T.C.; city surveyor. 'Bus garage (£17,857), for the T.C.; town clerk.

LIVERPOOL.—Housing scheme (104), Norris Green Estate (deposit £1 1s.); acting director of housing, Municipal Buildings, Dale Street.

LONDON (Leyton, E.).—Public wash-houses, for the T.C.; borough surveyor.

(Millwall, E.).—Re-erection (after fire) of mills, for N. J. Fenner & H. B. Alder & Co., Ltd., West Ferry Road (£25,000).

LUTON (Beds.).—Works extensions, Skefko Ball Bearing Co.

LYTHAM-ST. ANNES.—Cinema and café, Clifton Street, for the Blackpool Tower Co.

MANCHESTER.—Motor-'bus garage, Princess Road car depôt (deposit £1 1s., steelwork specification); city architect, Town Hall.

MARCH.—Infants' school; Isle of Ely Education Committee.

MARGATE.—Cottage hospital (80 beds); Reg. Elliott, builder, Northdown Road.

NELSON.—Housing scheme (94), Hodge Estate; borough surveyor.

NEWARK.—New block of buildings, Magnus Grammar School; Notts. county architect.

OLD FLETTON.—Housing scheme (32), for the U.D.C.; H. W. Hawkins, surveyor (returnable deposit of £1 1s.).

OLDHAM.—Filtration works, filter, power and chemical houses, Longden End, Littleborough (deposit £3); waterworks engineer, Plethorne, Newchurch, near Rochdale.

OTLEY.—Shops, Newall Carr; Leeds Co-operative Society.

OXFORD.—Extensions, Cowley Road; Oxford Co-operative Society. Additions, St. Aldate's School, St. Aldate's Street; Rev. C. M. Chavasse. Additions, St. Basil's House, Magdalen Road; Sister Superior. Alterations and extensions, Magdalen College; trustees.

PRESTONPANS.—Housing scheme, West Bowling Green; borough surveyor.

PRESTWICH.—Extension of sewage disposal works; surveyor to U.D.C.

RENFREWSHIRE.—Conversion of premises into offices and house for road surveyor; clerk, County Council, Paisley.

RETFORD.—Alterations, High School for Girls (£3,167); Greenwoods (Mansfield), Ltd.

RICHMOND (Surrey).—180 flats and 60 lock-up garages, Gloucester House Estate, Kew Road, for R. Gibson.

ROCHDALE.—Municipal offices; borough surveyor.

ROSSENDALE.—Town planning scheme for Bacup, Haslingden and Rawtenstall; J. Whalley, hon. secretary, Rossendale Regional Town Planning Committee, Town Hall, Rawtenstall.

ST. ALBANS.—Church hall (£4,550), for the Wesleyan trustees; C. Gordon Smith, architect.

SELBY.—Housing scheme (36) (deposit £1); Blenkinsopp and Scatchard, architects, Clifton Chambers, Park Street.

SOUTHAMPTON.—Maids' home, Royal South Hants Hospital; Gutteridge & Gutteridge, architects, 9, Portland Street (returnable deposit of £2 2s.).

SOUTHEND-ON-SEA.—Girls' high school, Westcliff, for the Borough E.C.; education architect.

SOUTH SHIELDS.—Garage for 40 'buses, Mile End Road; H. A. Stagg, secretary, Northern General Transport Co. Blocks of tenements, Mitre Street area; borough engineer. 28 houses, Marsden Road, for miners' homes; Henderson & Woolgar.

SOUTHWELL.—Extensions, Minster Grammar School; governors.

SPENBOROUGH.—Town Hall extensions, for the U.D.C.; surveyor, Cleckheaton.

STIRLING.—Renovation of Unipace Parish Church; J. Melvin & Sons, architects, Alloa.

STOCKTON-ON-TEES.—School, Norton (£31,624), for the Borough E.C.; J. S. Purdey, director of education.

STOKE-ON-TRENT.—Works, for Robert Hyde & Son, Ltd., iron and steel founders, Abbeydale Foundry, Sheffield.

STRETFORD.—264 houses, Barton Road Estate; U.D.C. surveyor.

SUTTON (Surrey).—Church and lecture hall, for the Primitive Methodist trustees; H. K. Armitage.

TENTERDEN.—Extensions to Institution, for the B.G.; Kent county architect, 86, Week Street, Maidstone (returnable deposit of £2).

UPTON.—Parish hall, with electric lighting; G. Hutchins, architect, Lache Lane, Chester.

WARRINGTON.—Alterations and extensions, 19-21, Sankey Street; F. W. Woolworth & Co., Ltd.

WEST WICKHAM (Kent).—Development of estate for residences, for T. H. Jones, builder.

WISBECH.—Improvements, Nene Quay (£12,000); borough engineer.

WORTHING.—Presbyterian Church and Hall; trustees.

YORK.—50 houses, Tang Hall Estate; city engineer. Reconstruction of old Queen Street Schools as warehouses; city engineer.